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14. ABSTRACT

Saint Francis University's CERMUSA continues to explore ways to identify, study, analyze, and explore innovative and interdisciplinary ways to deliver healthcare and education to rural and underserved populations using commercially available off-the-shelf technologies (COTS) and adapts the equipment to address the identified needs that enhance and aid access to cost effective, quality healthcare and education. CERMUSA's protocols identify technologies or paradigms and diffuse them into healthcare initiatives. CERMUSA was engaged in a number of studies encompassing chronic diseases, diabetes, and effect of synchronous and asynchronous methods of distance learning. CERMUSA completed a successful research protocol assisting rural hospitals to develop a network capable of providing education services and certification to pre-hospital students. CERMUSA successfully designed a modular and rapidly-deployable communications network for emergency and tactical response that extends radio coverage within buildings where service is unavailable. The Mobile Access Point was developed as a fully-functional node on the CERMUSA Mesh Network mounted on a wheeled robotic chassis. This extends network services via remote control, thereby keeping a remote operator out of potentially dangerous areas such as disaster zones or contaminated regions. CERMUSA's Wound Care protocol has provided the access to a wound-specialty nurse to tend to several patients simultaneously using portable video units and the two way communication allowed the patient to have one-on-one interaction with the expert caregiver.

15. SUBJECT TERMS
Telemedicine, Telehealth, Mesh Networking, Distance Learning, Distance Education, Assistive Technology, Internet2, Off-the-Shelf Technology
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FY06 Research Summary

Today's society expects better healthcare. As baby-boomer generation approaches retirement age, their demand for better healthcare and other services, which are essential for maintaining robust and disease free health, is on rise. The United States spends over $6,500.00 per person for healthcare costs a year. In 2005, over $2 trillion was spent in healthcare (Source: Centers for Medicare and Medicaid Services, Office of the Actuary, National Health Statistics Group; http://www.cms.hhs.gov/NationalHealthExpendData/). Four themes have emerged from the 2005 National Healthcare Quality report: healthcare quality continues to improve at a modest pace; the healthcare quality improvement is variable; healthcare quality has not reached the optimum level; and healthcare quality improvement rate is sustainable. Although significant advances in human healthcare have increased our life expectancy, they have not crossed the city limits to the extent they should have, and that is well reflected in rural-area healthcare issues. In short, quality healthcare is easily accessible to city dwellers but remains a pipe dream for the rural population. Geography plays a mitigating role in healthcare disparities. E.g.: Remote rural populations are clearly at risk for having worse access and receiving poorer quality care. Thus differential access results in disparity in quality healthcare. To address these discrepancies, numerous state and federal programs and policies are put in place to provide quality healthcare; however, barriers remain. To circumvent those, telehealth and telemedicine is gaining a strong foothold in rural communities. Rural area residents are not as lucky. Remote areas and sparse populations make it difficult for hospitals to offer the advanced healthcare. When weather is uncooperative, access to available hospitals becomes even more challenging. Thus, unavailability of decent hospital care and lack of reliable communication are the woes that only rural and remote areas can understand and appreciate. Telemedicine and telehealth are viable solutions for this problem which requires a good and sustainable communications alternative. Offering medicine from a distance where distant areas and its populations are brought closer via telecommunications technologies is termed as "telemedicine". However, diffusion of these technologies into the real world is challenging. A meta-analysis of the literature clearly suggests that telecare has a significant role in supporting the elderly population (J. Telemedicine Telecare, 13, pp 293-297 (2007)). Although this report addresses the needs of only the elderly, one can confidently argue that it is applicable to everyone, especially those living in remote and rural areas. Therefore, redesigning of services should be a major goal of medical providers. At CERMUSA, we perform studies that are designed to investigate methodologies which will provide valuable information and set directions and standards for our future studies designed to help those living in the remote and rural areas of the state, with a connotation that such services could also be extended to military personnel when away from the base: frontline soldiers.

Ever since its inception, CERMUSA had and continues to explore ways to identify, study, analyze and explore innovative and interdisciplinary ways to deliver healthcare to rural western Pennsylvania. For this, it uses commercially available off-the-shelf technologies (COTS), adapts the equipment to address the identified needs with a common goal to enhance and aid access to the healthcare and education in rural, remote, and underserved regions. This is a cost-effective and sustainable way to address specific needs. Many CERMUSA protocols are concerned with identifying the technologies or paradigms and diffusing them into healthcare initiatives that will benefit individuals. If advocated, existing technologies should and are shifting the paradigm of medical care, albeit slowly. One would assume that this shift should help people living in remote areas. However, this diffusion has not been easy. Telemedicine, telehealth (e-Health) and distance learning (e-Learning) are becoming an integral part of the paradigm through which the patient is cared for and educated at distance.

During 2007, CERMUSA was engaged in a number of studies encompassing chronic diseases, diabetes, and effect of synchronous and asynchronous methods on distance learning. It should be pointed out that a number of studies were slowed down due to IRB administrative issues that could not be resolved on a timely basis. As a result, several studies were either prematurely terminated or remained incomplete. The following is a summary of results of the studies carried out during the year and their implications.

Telehealth and Telemedicine:
1) Amyotrophic Lateral Sclerosis (ALS) is a progressive neurological disease (often called Lou Gehrig's disease) which affects all voluntary muscles, ultimately resulting in difficulty swallowing, speaking, breathing, ambulating, and initiating fine motor tasks. There is growing evidence that military personnel who served between 1910 and 1982 are at an almost 60% increased risk of ALS than those who did not serve. Unfortunately, lack of qualified subjects and inability of timely IRB approvals from various organizations forced us to terminate this study. However, background literature search and the survey of various instruments that could be used for the study has allowed us to better prepare for possible future initiatives. 2) As the baby boomers age, their primary concern remains to be the disproportional healthcare cost. Debilitating chronic diseases is on rise. Stroke, the leading cause of disability, is responsible for death for nearly a third of its victims—approximately 150,000 Americans each year. Two-thirds of all strokes occur in people over age 65, with men more affected than women, although women are more likely to die from a stroke. One of our studies was an attempt to explore how an electrically driven and FDA listed robotic device can help stroke affected patients living in remote areas rehabilitate. This project had several phases including a "pilot study" phase. Unfortunately, delays in obtaining IRB approval and stringent inclusion-exclusion criteria prevented a robust recruitment. Our partner, the John P. Murtha Neuroscience Pain Institute (JPMNPI) and the Memorial Medical Center (MMC), located in Johnstown, Pennsylvania, were to perform the main body of research and CERMUSA was to provide the "technical" support" and evaluate "telerehabilitation outcomes". However, at this juncture, CERMUSA has officially withdrawn from participating in this study. 3) Rural communities lack basic infrastructure capable of providing high quality information that is important for improving quality of life and communal growth and development which is essential for business recruitment and economic growth. This year CERMUSA terminated a project which has helped a number of local hospitals to develop and sustain a network of rural hospitals capable of providing education services such as certification and continuing education to pre-hospital students, as well as patient education modules using video teleconferencing units. The project is very successful because it has allowed certification and review programs for paramedics, a need that was unmet for a long time. This work has brought telemedicine to the local levels and helped demystify the concept of telehealth

and telemedicine for those who are unfamiliar and uninformed of this modern paradigm. Such projects are important because they address needs of remote and medically underserved rural areas of southwest central Pennsylvania. Similarly, the FREC-M project was also terminated because it achieved its goal. CERMUSA was able to show the utility of communication and how it could be used through various terrains and successfully integrate modern technology into everyday competing workload demands in the hospital setting. Unfortunately, the end user was not ready for adopting this technology. Similar vehicles are in use in other parts of the country. The major difference is that in other cases, the end user was willing to change and accept the role of technology in everyday world. This study has taught us important lessons about what works and how differences in people affect the outcomes. 4) Current U.S. data show that 17% of children and adolescents aged 2–19 years are overweight and that another 17% are also at risk for being overweight (JAMA 2006;295(13):1549-55). What is more, being overweight during childhood increases the risk for adult cardiovascular morbidity (N Engl J Med 1992;327(19):1350-5). Obesity raises the risk of developing many diseases including diabetes, cardiovascular disease, hypertension, stroke, osteoarthritis, and cancer (CDC, 2007a). There are several evidenced-based curriculums on the prevention of obesity available for elementary and junior high school students; however, there are very few resources available for high school students in the prevention of obesity. Last year a study was initiated to educate high school students and make them aware of the risks associated with obesity. Currently, we are processing those data and results appear very promising. We plan to continue with this study by expanding it to other school districts within Cambria County, Pennsylvania. 5) Several other telehealth/telemedicine studies progressed very well. The wound care project used portable video unit for home wound care visits. This allowed the wound-specialty nurse to tend to several patients simultaneously. More importantly, this study showed the end user, as well as Home Nursing Association, how effective and efficient the process can be. The two-way communication allowed the patient to have one-on-one interaction with the expert caregiver, who on the other hand, could visit and examine the patient and monitor progress without leaving the office. In the long run, this study will be adopted by various other organizations serving the rural community where experts are in short supply, and save them funds which they can appropriate for other purposes. We also showed that video conferencing can be used effectively to train and inform people located at various locations. The utility of this study was apparent when one of the supervisors complimented this study because it saved the organization travel time and funds. Although another study designed to educate people with disabilities about obesity and healthy lifestyles worked well and helped researchers to evaluate the paradigm used for this study, it was clear that people need to overcome computer illiteracy, realize the importance of healthy lifestyles and the stigma associated with the word "obesity". The take home message is that people are more receptive to the idea of maintaining weight than losing weight. These factors prompted us to discontinue this study.

Distance Learning:

The role of distance learning (DL) in modern education is becoming very prominent. DL is remote learning that allows people to attend schools and obtain education without setting foot on school or college campuses. There are five important elements of DL: instructor, peers, learner, content, and delivery mechanism or technology. A learner interacts with the teacher, content, other learners (peers) and technology. The advent of technology has shifted the teaching paradigm from face-to-face interaction to a blended approach consisting of direct as well indirect interaction. The learning management tools play an important role. CERMUSA was one of the few organizations involved in testing a variety of learning management technologies (LMT). The study began few years ago and now we have completed this research which studied the utility of LMTs and its impact on distance learning. It has become evident that there is no one particular LMT which fares the best. Although face-to-face learning is considered best, an increasing number of educators are employing a blended approach. We are employing the lessons learned to current as well as future studies. For example, pharmacists and pharmacy technicians in rural areas are at a disadvantage because they do not have an easy access to continuing medical education credit required by attending educational opportunities, that otherwise are available to city dwellers. Using a variety of education delivery methods (Internet webinars, online monographs, or U.S. mail monographs) to licensed pharmacists and pharmacy technicians in rural and underserved areas, the effectiveness of these techniques was measured. The analysis of responses from a robust sample of participants clearly showed that webinar was the most preferred choice for distance learning. The majority of participants not only would attend more webinars but would recommend them to their colleagues. In short, distance learning has definitely found roots in rural and remote areas. This implies that similar methods of learning could be extended to our military personnel when they are away from their homes. Such opportunities will help them use their free time to learn and advance in their civilian careers. This will help them to move into mainstream without losing opportunities, especially when the research has shown that new college graduates need to be multi-talented to succeed in the dynamic environment by becoming jack of all trades. The distance learning staff also studied the role of broadband in education. Although the utility of the broadband in distance learning is apparent, it is important to know how it impacts a student's ability to enhance his/her knowledge. It is important to engage and keep the interaction between the students and teachers as active as possible. These studies pointed out the importance of instant response and how time lag can affect the learning. For this reason, faster speed is important. Thus, one teacher can access several nodes and instruct a large number of students at various locations. This will be very useful in the military where a central command can train individuals or consult with a large number of individuals at multiple locations and arrive at a logical decision.

Wireless Testbed:

One of our missions is to research new technologies for their inclusion in our studies and, at times, find solutions to meet needs. During past year, to gain assistance in extending radio coverage within several buildings where voice radio service is largely unavailable because the handheld radios are simply incapable of making contact with the radio repeater tower, we designed a modular and rapidly-deployable communications network for emergency and tactical response. Although not a new idea, use of COTS and integrated design has made this equipment unique. We have applied for patents for this design and application. Currently, this device is being tested by the local fire department. Their test results and opinions will help us to make it equipment that can be used by emergency personnel, fire departments, and military where out-of-reach places will be made accessible. Similarly, The Mobile Access Point (MAP) was developed as a fully-functional node on the CERMUSA Mesh Network mounted on a wheeled robotic chassis. This extends network services via remote control, thereby keeping a remote operator out of potentially dangerous areas such as disaster zones or contaminated regions. Also, inclusion of a video camera (for remote teleoperation and scene assessment), an onboard micro PC with videoconferencing software, and a microphone and speakers (to allow for communication with potentially injured or contaminated individuals) on MAP will enhance utility of this equipment; by using a "daisy-chain" scenario, multiple MAP units could be extended over ridges or other obstacles to extend network coverage within mesh performance limits.

The significance of our studies is far reaching. During the course of emergency situations, the paradigms that we have adapted should help medical personnel or first responders to communicate in an area that otherwise will be difficult to reach. During the course of international dispute, the military personnel will be able to continue with their education by attending local educational institutes when they are not engaged in combat. Similarly, they will be able to deliver the medical help when and where it will be needed the most, irrespective of the remote location. Thus, CERMUSA studies attempt to reach rural areas of Pennsylvania as well as locations where troops or military personnel do not have an easy access to quality education and healthcare.

The studies described about are also designed to save future healthcare as well as education costs. The wound care project and obesity-related projects will help reduce trips to the doctors or the specialists. In addition, by maintaining healthy habits, the life expectancy will also increase. This could translate into a healthy and experienced work force that will be paying taxes and contributing to the economy. Distance learning paradigms will help individuals (military and civilian) to complete education even when deployed, thus saving travel.

One of the rate limiting steps is obtaining IRB approvals. On several occasions, a delay in these approvals make the technological solutions obsolete. As a result, in years ahead CERMUSA is adopting a paradigm which will allow it to test the equipment and validate the concept by doing a thorough background study prior to undertaking the study. This will eliminate unnecessary delays in processing and the studies will continue on a more timely basis.

In coming years, CERMUSA, with recently streamlined processes and well pre-researched robust proposals, will explore ways to serve hard-to-reach areas of the rural Pennsylvania using innovative technologies and easy-to-use methodologies. It will continue to explore ways that will allow home monitoring of homebound patients, as well as educate them to remain compliant with the medical requirements. This will also impact military since our brave men and women of this great country need us to provide them with the best that we can offer. Through telehealth and telemedicine, as well as distance learning approaches, CERMUSA will attempt to enhance the lives of others.

CERMUSA FY06 STAFFING LIST

STAFF MEMBER	ROLE
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Saint Francis University
CERMUSA FY06 Publications and Presentations
January 2007 to January 2008
(listed most recent first)

Rural Health Publications (7)

CERMUSA Newsletter. (December 2007). Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas.

CERMUSA Newsletter. (August 2007). Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas.

Anderson, K. (DL Course Management Specialist). (June 2007). Handheld Learning: Exploring Issues and Ideas Related to Integrating Portable Technology into the Classroom. *Proceedings of the 2007 ASCUE Summer Conference,* pgs 21-27.

Gerraughty, J. (Electronic Classroom/Video Production Manager) & Tonkin, K. (Assistant Director for IT). (June 2007). Extending Internet2 to Rural Schools. *Proceedings of the 2007 ASCUE Summer Conference,* pgs 48-56.

Gerraughty, J. (Electronic Classroom/Video Production Manager) & Tonkin, K. (Assistant Director for IT). (June 2007). Music from the Mountains: Providing Live Music Arts Education Using Internet2. *Proceedings of the 2007 ASCUE Summer Conference,* pgs 137-145.

CERMUSA Newsletter. (Spring 2007). Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas.

Litzinger, G. (Telemedicine Development Specialist), Rossman, T. (UPMC-CNS), Demuth, B. (Assistant Director for Telehealth), & Roberts, J. (Director). (February 2007). In-Home Wound Care Management Utilizing Information Technology. *Home Healthcare Nurse Magazine, Vol. 25, (No. 2),* pgs 119-130.

Rural Health Presentations (35)

Holiday Traditions Conference – CERMUSA Hosting Interactive Videoconference via Internet2, (2007, December 14). Loretto, PA: CERMUSA.

Gerraughty, J. (Electronic Classroom/Video Production Manager). (2007, November 20). *Internet2: Bringing "Far-Away" Science into your Classroom.* Saint Francis University's Science Day. Loretto, PA: CERMUSA.

Shanafelt, M. (Senior IT Advisor) & Miller, J. (Work Study Student). (2007, November 20). *GIS: Using Google Earth to Make a 3D Model of Saint Francis University.* Saint Francis University's Science Day. Loretto, PA: CERMUSA.

Makin, J. (Technology Support Specialist) & Wolfe, D. (Wireless Communications Specialist). (2007, November 20). *MAP-Robotic Network Hotspot and Video Conferencing on the GO 15.* Saint Francis University's Science Day. Loretto, PA: CERMUSA.

Mainhart, R. (Program Manager), Bickford, S. (TM Handheld Computing Specialist), & Bender, T. (Communications Platform Technology Manager). (2007, November 20). *Saving Lives from Space – Using Satellite Telecommunications for Disaster Response 15.* Saint Francis University's Science Day. Loretto, PA: CERMUSA.

National Telerehabilitation Service System (NTSS). CERMUSA Hosting Assistive Technology Exposition, (2007, November 14). Johnstown, PA: CERMUSA/NTSS

Litzinger, G. (Telehealth Development Specialist). (2007, November 9). *CERMUSA's Research: Rural Healthcare Solutions.* Presentation to Nursing Students at the University of Pittsburgh at Johnstown. Johnstown, PA: CERMUSA.

Tonkin, K. (Assistant Director for Information Technology), Roberts, J. (Director), Mainhart, R. (Project Manager), Knee, D. (Technology Coordinator), & Litzinger, G. (Telehealth Development Specialist). (2007, September 13). *Demonstration of capabilities for U.S. Navy: MCP, Telehealth studies, and the RoIP project.* Washington, D.C.: CERMUSA.

Cronin, G. (Instructional Designer). (2007, August 22). *Respondus & Study Mate.* Saint Francis University Community Development Week. Loretto, PA: CERMUSA/SFU.

Tonkin, K. (Assistant Director for Information Technology), Wolfe, D. (Wireless Communications Specialist) & Roberts, J. (Director). (2007, August 16-17). *Robotic Networking Demonstration - Mobile Access Point (MAP).* ArmTECH Showcase of Industry & Technology. Kittanning, PA: CERMUSA.

Griffin, R. (Assistant Director for Distance Learning) & Gerraughty, J. (Electronic Classroom/Video Production Manager). (2007, August 16-17). *Distance Learning Case Study Project.* ArmTECH Showcase of Industry & Technology. Kittanning, PA: CERMUSA.

Fuska, M. (Telehealth Technology Coordinator) (2007, July 3) *Assistive Technologies.* Saint Francis University Occupational Therapy students, HGA, Johnstown, PA: CERMUSA.

Mainhart, R. (Program Manager) & Bender, T. (Communications Platform Technology Manager). (2007, May 31 & June 1). *Growth through Collaboration and Synergy - Mobile Communications Platform.* Showcase for Commerce. Johnstown, PA: CERMUSA/Coherent Systems International/Kuchera Defense Systems.

Mainhart, R. (Program Manager), Bender, T. (Communications Platform Technology Manager) & Wolfe, D. (Wireless Communications Specialist). (2007, July 26-27). *Operation Red Rose - Communications Demonstration & Support.* Pennsylvania National Guard Disaster Response and Interoperability Exercise. Lancaster, PA: CERMUSA/UPMC.

Mainhart, R. (Program Manager), Litzinger, G. (Telehealth Development Specialist), & Bender, T. (Communications Platform Technology Manager). (2007, June 21). *Mobile Communications Platform Overview.*Steering Committee on Telehealth and Healthcare Informatics. Capitol Hill, DC: CERMUSA.

Gerraughty, J. (Electronic Classroom/Video Production Manager). (2007 June 10-14). *Extending Internet2 to Rural Schools.* Association of Small Computers Users in Education (ASCUE) Conference, Myrtle Beach, SC: CERMUSA

Gerraughty, J. (Electronic Classroom/Video Production Manager) for Tonkin, K. (Assistant Director for IT). (2007 June 10-14). *Music from the Mountains: Providing Live Music Arts Education Using Internet2.* Association of Small Computers Users in Education (ASCUE) Conference, Myrtle Beach, SC: CERMUSA

Shanafelt, M. (Senior Information Technology Advisor), Miller, J. (CERMUSA Work Study Student), & Yeager, N. (Summer Engineering Intern). (2007, June 11-15). *Robotics Workshop Instructors,* Saint Francis University's Continuing Education 2007 Kid's Camp, Loretto, PA: CERMUSA.

Roberts, J. (Director). (2007, June 7). *CERMUSA Update.* Saint Francis University Board of Trustees Meeting, Loretto, PA: CERMUSA.

Tonkin, K. (Assistant Director for Information Technology), & Roberts, J. (Director). (2007, May 31 & June 1). *Radio over IP – Mesh Networking.* Showcase for Commerce. Johnstown, PA: CERMUSA.

Demuth, B. (Assistant Director for Telehealth), Anderson, K. (DL Course Management Specialist), & Griffin, R. (Assistant Director for Distance Learning). (2007, May 31 & June 1). *Specialized Medical Training for Rural Medicine (Traumatic War Injuries).* Showcase for Commerce. Johnstown, PA: CERMUSA.

Mainhart, R. (Program Manager) & Bender, T. (Communications Platform Technology Manager). (2007, May 31 & June 1). *Growth through Collaboration and Synergy - Mobile Communications Platform.* Showcase for Commerce. Johnstown, PA: CERMUSA.

Gerraughty, J. (Electronic Classroom/Video Production Manager). (2007 May 17). *Computer-Based Video Production.* Association of Information Technology Professionals (AITP) Meeting, Johnstown, PA: CERMUSA

Litzinger, G. (Telehealth Development Specialist). (2007, May 13-16). *Enhanced Wound Care Management Utilizing Information Technology.* 2007 ATA Annual Conference, Nashville, TN: CERMUSA.

Mainhart, R. (Program Manager). (2007, May 13-16). *REMeD-D: Putting together the automated casualty care puzzle.* 2007 ATA Annual Conference, Nashville, TN: CERMUSA.

Roberts, J. (Director). (2007, May 13-16). *IT and Telecom Departments on Wheels: the Mobile Communications Platform.* 2007 ATA Annual Conference, Nashville, TN: CERMUSA.

Anderson, K. (Distributed Learning Course Management Specialist). (2007, April 25-27). *Mastering Distance Education Strategies: Research and Reflections of a DL Study on Course Delivery and Assessment Strategies.* American Educational Research Association's Northeast Division Conference, Portsmouth, NH: CERMUSA.

Shanafelt, M. (Senior Information Technology Advisor). (2007, April 21). *Freedom Calls Demo.* Armed Services Symposium, Somerset, PA: CERMUSA.

Wendekier, C (Telehealth Developmental Specialist) & Knee, D. (Technology Coordinator). (2007, March 23). *Telehealth Presentation/Demonstrations to SFU Physical Therapy Students.* CERMUSA.

Tonkin, K. (Assistant Director for Information Technology), Bender, T. (Communications Platform Technology Manager), & Makin, J. (Technology Support Specialist). (2007, March 13-15). *Capabilities of the Mobile Communications Platform.* Pennsylvania Law Enforcement EXPO, Harrisburg, PA: CERMUSA.

Griffin, R. (Assistant Director for Distance Learning). (2007, March 5-6). *Discover How Virtual Classroom Software Can Revolutionize Your Distance Education Classroom.* Teaching and Learning Conference, Pittsburgh, PA: CERMUSA.

Fuska, M. (Telehealth Technology Coordinator) (2007, February 20) *Assistive Technologies.* Saint Francis University Physical Therapy students, HGA, Johnstown, PA: CERMUSA.

Griffin, R. (Assistant Director for Distance Learning). (2007, February 9). *Keynote Address.* C-CUE Student Technology Forum - Indiana University of Pennsylvania, Indiana, PA: CERMUSA.

Miller, J. (Student Assistant) & Shanafelt, M. (Senior Information Technology Advisor). (2007, February 9). *Mapping the SFU Campus Using Google Earth and SketchUps.* C-CUE Student Technology Forum - Indiana University of Pennsylvania, Indiana, PA: CERMUSA.

Griffin, R. (Assistant Director for Distance Learning), Friedman, D. (Technology Coordinator), & Miko, J. (Application Development Specialist). (2007, January 18-19). *Discover How Virtual Classroom Software Can Revolutionize Your Distance Education Classroom.* Educause Mid-Atlantic Regional Conference, Baltimore, MD: CERMUSA.

Rural Health Poster Presentations (9)

Anderson, K. (Distributed Learning Course Management Specialist). (2007, October 23-26). *Handheld Learning: Exploring Issues and Ideas Related to Integrating Portable Technology Into the Classroom.* EDUCAUSE Conference, Seattle WA: CERMUSA.

Mainhart, R. (Program Manager). (2007, November 5). *CERMUSA Research Overview.* Conemaugh Valley High School's Health Care Careers Week Health Fair. Johnstown, PA:

Wendekier, C. (Telehealth Development Specialist). (2007, November 3). *Diabetes Research Studies.* Conemaugh Diabetes Institute's Diabetes Fair. Johnstown, PA

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Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: First Responder Emergency Communication-Mobile (FREC-M)

Protocol No.: 05-TATTH207-05

Date: March 12, 2008

Protocol Title: First Responder Emergency Communications-Mobile (FREC-M)

Principal Investigator: Gina L. Litzinger, RN, MSN

Protocol Executive Summary:

This research protocol focused on new communications technology used in rural areas of southwest central Pennsylvania from a moving ambulance, the First Responder Emergency Communication-Mobile (FREC-M), to receiving emergency room tertiary care centers. CERMUSA researchers equipped FREC-M with radios, cellular phones, and satellite technologies proficient in sending digital readings (twelve-lead ECG, blood pressure, and pulse oximetry) and video data to the receiving facility's emergency department.

Implementation of an organized test plan occurred in the designated five-mile test bed around Saint Francis University, utilizing ten random test point locations. CERMUSA conducted further data and voice transmission testing in the five-mile test bed, using 64 new sites. Results obtained from both testing periods demonstrated successes in accurate, real-time data and vital sign transmissions from a moving platform in the expanded test bed area.

Cresson Area Emergency Medical Services (EMS) received the FREC-M ambulance prior to implementation of the research protocol; allowing paramedics to complete preliminary technology field testing and become familiar with the technology before inception of the study. CERMUSA instructed end-users, such as Cresson EMS, to evaluate the technology on each transport pertaining to ease of use and describe any type of difficulty that arose during that emergency transport. CERMUSA intended to study and evaluate the technologies medical personnel used, explore difficulties encountered, review user evaluations of these technologies, and performed cost analysis. Many obstacles prevented instruction, evaluation, and analysis. As a result, no data were obtained from this study, leading to its premature termination.

Introduction:

Pennsylvania's geography, like many parts of the United States, houses vast expanses of sparsely populated areas. As a result, wireless communication service in these areas varies from passable to non-existent. "dead spots" where radio or cell phone connectivity is impossible hinder emergency service providers in their efforts to provide care. Rural areas are often located great distances from advanced medical care and hospitals, especially the tertiary care centers that provide sophisticated, emergent and specialty care. The remote location of these populations, weather and geography, created problems within the realm of emergency medical care and treatment due to the inconsistent or lack of communication capabilities. The environmental surroundings within these remote areas created many unique challenges for the prehospital healthcare provider (Woollard, 1999). Many rural areas faced difficulties transmitting and retrieving wireless signals due to the lack of radio, cellular, and repeater towers. The lack of this supportive infrastructure further complicated the problem of the wireless signal transmission (Mellot, 2002). Although well trained, first responders may encounter many situations requiring a higher level of hospital care. First responders faced difficulties establishing, maintaining and documenting continuous communications during patient transport. Communications may make the difference between life and death of the critically ill or injured patient (Gandsas, et. al, 2000).

FREC-M appeared to offer a solution allowing continuous communication with the receiving facility hosting highly trained healthcare providers.

A wide variety of mobile Emergency Medical Services exist throughout the United States, each using different types of technology and bandwidth (Caputo, 2003; Salinas, 2002; Levine, 1999; Ricci, 2002). Each service strives to meet a specific need in the community. These programs bring high quality care to the prehospital patient. The applications of all these protocols may still create instances of inaccurate or corrupted clinical data, making it unacceptable in critical care. FREC-M's technology was designed for the transmission of medical information such as vital signs, ECG, and pulse oximetry. Throughout this study, CERMUSA continued to identify technology for transmitting continuous audio, video, and medical information to the hospital during emergency situations. CERMUSA equipped the ambulance with radios, cellular phones, and satellite technologies proficient in sending digital and video data to a receiving facility. Preliminary testing from the ambulance demonstrated appropriate approaches to resolving the communication difficulties faced by the prehospital healthcare providers in Western Pennsylvania.

CERMUSA implemented an organized test plan in the designated five-mile test bed around Saint Francis University utilizing ten random test point locations. FREC-M housed a laptop equipped with digital radio audio and data transmission software, a screen capture utility, a professional quality printer, and medical equipment to measure twelve-lead ECG, blood pressure, and pulse oximetry. CERMUSA planned a travel route and took exact printouts of vital signs from the ambulance at each test point. Testing occurred at several locations, both while moving and at stationary positions. After successful transmission at all sites, CERMUSA personnel returned to the office to compile and compare data by reviewing the time frame from each of the ten site readings to the printings from the hospital workstation laptop.
Further testing for data and voice transmission occurred in the five-mile test bed utilizing an additional 64 sites. The results obtained from both testing periods indicated that the data transport system (Motorola ASTRO radio system) functioned properly.

Comparison of transmitted ECG signals included the PR interval, QT interval, and the R-R interval (in all three testing scenarios) revealed no discernable differences from the ambulance setting to the hospital emergency department. Therefore, CERMUSA personnel determined that accurate, real-time data and vital sign transmissions through the medical monitoring software was possible over the Motorola ASTRO radio system from a moving platform in the expanded test bed.

Military Significance

This advanced technology will permit those in the field, whether domestic or military, in peace or in wartime, to maintain contact with and be under the supervision of a medical command or a "Military Forward Surgical Team or Combat Support Hospital" trauma physician during transport of a critically ill or injured patient. Rural areas that our troops encounter will be the place where this technology is vitally important in bringing sophisticated, timely care to the wounded soldier in the field.

Public Significance

In addition to the provision of adequate communications infrastructure throughout the rural areas to provide care to the patient enroute to the hospital, FREC-M could actually be used as a mobile staging unit at a disaster such as the crash of "Flight 93" or the "Quecreek Miners" episode. The vehicle could also to connect with police, fire, EMS, and disaster response teams with the advanced radio and satellite connections providing audio, video, and data transmissions that would be needed in site.

Methods:

This was an experimental, quantitative, qualitative, descriptive research study related to audio, data and video transmission from the ambulance to the hospital between Loretto (northern Cambria County) and Memorial Medical Center in Johnstown, PA. Technology within the FREC-M includes Very High Frequency (VHF) and Ultra High Frequency (UHF) digital radios and low band analog radios, Tuff Book Panasonic computer with Ortivus Software for digital radio audio and data transmission (voice, vital signs and text messaging), INMARSAT Satellite technology with LED monitor, 2 cameras in the back of the ambulance facing the patient and paramedic, one overhead camera (over the patient) capable of panning and zooming for physician access to patient appearance. An outside camera on the cab of the vehicle allows visualization of the scene with a 300 degree circumference with panning and zooming capabilities. This permits the paramedic to show the receiving hospital the scene and mechanism of injury of the patient prior to extrication and transport.

How FREC-M Works:

On arrival at scene, the paramedic takes the laptop and Bluetooth monitoring apparatus to the patient (if appropriate) and places it on the patient. If the encounter run involves a trauma patient and the medical command or the paramedic deems it appropriate to send video of the scene to the hospital without compromising the care of the patient, EMS will establish a video connection utilizing the outside camera on the ambulance to send back real time video from the scene to the tertiary care center. Next, transfer of the patient to the ambulance on a secured litter occurs, locking the litter down on the ambulance floor as per EMS protocol. The Bluetooth monitoring system sends the data to the laptop in the ambulance, then EMS personnel establish the communication to the hospital utilizing the appropriate communications device, amplified cellular for Altoona or digital radio for Johnstown. Transmission of data (twelve-lead electrocardiogram, blood pressure, heart rate and pulse oximetry) to the hospital proceeds after a communication connection occurs. The paramedic makes the initial audio connection to the hospital emergency department alerting the staff of incoming data transmission into the laptop located in the medical command room. As per EMS protocol, the paramedic gives an initial report to medical command and receives any orders. If the medical command physician wishes to see the patient, the EMS personnel establishes the video connection to the hospital through satellite technology. The video connection remains long enough for the physician to make his or her assessment and then the connection is discontinued. However, audio and data connection may continue until patient arrival at the hospital and report given to the emergency room personnel . EMS print the current twelve lead ECG and any other ECGs which the physician may find relevant and vital signs, on the available printer on the communication cart in the medical command room and place them on the patient's chart.

Staff members (ambulance and emergency department) complete evaluation forms after each transport using the study equipment. The PI collects these forms at the end of each month from the securely stored location at the hospital and ambulance station. CERMUSA uses the results of these evaluations to determine if the subjects felt the study equipment (technology) improved the communications during patient transport.

Issues and Resolutions

CERMUSA deployed FREC-M to the Cresson Area Ambulance prior to implementation of the research protocol. This decision allowed paramedics to complete preliminary technology field testing and become familiar with the technology before inception of the study. Preliminary testing indicated that the computer program being used was not user friendly, especially to individuals who had only limited knowledge of computer technology. Results from preliminary testing also indicated that paramedics encountered too many steps with the computer used to establish satellite access while attempting to care for the patient. CERMUSA instructed the paramedics to start the data transmission equipment on the computer while en-route to the patient pick-up location, and to turn on the satellite system modems while en-route to the patient, thus reducing steps needed to send video and data during patient care. However, they did not follow these instructions. Technical glitches also occurred in the hospital emergency departments with computers shutting down and not receiving the data being transmitted. Some of the laptop reboot problems resulted from overheating due to hospital staff piling paperwork and files on top of the computers limiting the airflow.

The technology installed in FREC-M became outdated due to technology innovations and availability of new modalities for prehospital care. New data transmission technology from competing manufacturers matured, demonstrating increased user friendliness, lower cost, and utilizing better technology for patient data transmission. This system is aligned with the technology currently used by many of the ambulance services in the Central Pennsylvania area. Cresson installed this equipment in their trucks at the request of Conemaugh Hospital.

CERMUSA determined that the B-GAN satellite system used for FREC-M's video transmission capabilities never functioned properly, despite assurance from the manufacturer that it would function in the manner that is was being used for. After many attempts at trying to make this satellite system work, CERMUSA researchers returned this satellite back to the manufacturer. Investigators found a cutting edge satellite system that would have worked well as a replacement. Due to the short amount of time left in the study, lack of financial support, and human factors, CERMUSA decided not to purchase this satellite system for the FREC-M vehicle.

Results and Analysis:

This project encountered several challenges throughout the year, resulting in a lack of data for the study.

Key Research Accomplishments:

- CERMUSA has demonstrated, through testing, that the FREC-M is capable of providing continuous communications between the prehospital providers and the emergency room physician throughout emergent transport.

- CERMUSA has demonstrated, through testing, the ability to transit information of clinical relevance safely and accurately to a medical command physician.

- CERMUSA has demonstrated, through testing, the ability to transmit information of clinical relevance reliably by comparing the information sent with the information received.

- CERMUSA has demonstrated, through testing, the capacity to provide a method of transmitting / receiving information that can be successfully integrated with the competing workload demands in the hospital setting.

Reportable Outcomes:

FREC-M will be presented at the 2008 American Telemedicine Association Conference.

Conclusions:

Our world is increasingly becoming more dependent upon technology. The technology and methodologies are updated almost daily. During the design phase of this project, the Ortivus system and the Motorola ASTRO Digital Radio System were the only technologies available. However, this medical technology was too complicated and adapting it to the mobile platform was difficult. Usability often means the difference between life and death in the prehospital community. The technical systems being implemented should not complicate the process of caring for patients but add value by assisting seamlessly to the care. This system adds another step to the standards of care that must be learned and integrated into the practice of prehospital emergent care.

Implementation of this protocol was not a failure. CERMUSA learned from the work completed during the past four years. All that occurred has value, if for no other reason, than to tell us what does or does not work or what is accepted/not accepted by the prehospital community.

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Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Test Bed for Rural Healthcare and Education

Protocol No.: 05-TATTH208-05

Date: March 12, 2008

Protocol Title: Test Bed for Rural Healthcare and Education

Principal Investigator: Brenda L. Guzic, RN, BSW, MA

Protocol Executive Summary:

High quality and information infrastructure is important for quality of life and is essential for community growth and development. Without sufficient infrastructure, rural communities struggle to maintain basic services and an appropriate quality of life for rural residents (Title VI). A viable health sector can be a major component of a community's infrastructure (Doeksen, 2003). Unfortunately, rural communities lack such infrastructure which is essential for the recruitment of businesses and economic growth. Therefore, it is crucial that rural communities have quality health services for all segments of the rural population.

During the past four years, Saint Francis University's CERMUSA has been instrumental in developing a rural healthcare enterprise and healthcare education model for southwest central Pennsylvania. This includes collaboration with Miners Medical Center, J.C. Blair Memorial Hospital, Broad Top Medical Center, Huntingdon Family Practice, Mount Union Medical Center, Lee Regional Health System, Children's Hospital of Pittsburgh, Altoona Regional Health System, Memorial Medical Center, Centre County Life Link, Clearfield County Emergency Medical Services (EMS), and Southern Alleghenies Emergency Medical Services Council (SAEMS). SAEMS participants include students from Bedford, Blair, Cambria, Fulton, Huntingdon, and Somerset Counties. The model allows for high quality, specialized healthcare to be available to the rural and medically underserved populations in three Pennsylvania counties including emergent and non-emergent patients in need of specialty consults at J.C. Blair Memorial Hospital, cardiac patients at Miners Medical Center, and specialty consults, translation services, and physician assistant precepting at the Huntingdon, Broad Top, and Mount Union Medical Centers in Huntingdon County, PA. At the present time education services (certification and continuing education) for pre-hospital students continues and patient education modules via video teleconferencing have been implemented. With the help of this protocol, CERMUSA continues to build a comprehensive, sustainable model for healthcare, healthcare and wellness education, high quality hospital information technology, and broadband communication access for the rural, medically underserved areas of southwest central Pennsylvania.

Introduction:

The delivery of quality specialty healthcare services and healthcare education to rural populations can be a difficult and challenging process. Many people living in remote and medically underserved areas have no or limited access to health services. Lack of transportation, inaccessibility to physicians and perceived cost of treatment, apprehension, and misconceptions about technology are just a few of the reasons why people do not seek or receive healthcare or health education. This lack of access to healthcare and health education may have a cascading effect on a person's physical, psychological, and emotional well-being. Telemedicine programs can be integral in providing health education and healthcare services to segments of the population who may not seek care or who might otherwise not have access to such opportunities.

The rural communities in southwest central Pennsylvania face problems which are present in other rural areas throughout the United States (Freeman, 2002). Therefore CERMUSA has established alliances with community based healthcare agencies, practitioners, and organizations in southwest central Pennsylvania in the development of a rural healthcare enterprise and education model entitled **Test Bed for Rural Healthcare and Education**.

The goals of this telehealth initiative are to increase access to and quality of healthcare to underserved residents by establishing an information network that includes; mechanisms for interactive video teleconferencing (VTC), distance learning, continuing medical education, and peer collaboration that is rural-practitioner driven.

CERMUSA, in collaboration with SAEMS, Clearfield EMS, Centre County Life Link, Miners Medical Center, J.C. Blair Memorial Hospital, UPMC Lee Regional Hospital, Conemaugh Health System, Broad Top Medical Center, Huntingdon Family Clinic, Mount Union Medical Center and Altoona Regional Health System implemented numerous technical pilot projects for telehealth in the care of adults and neonates, and education for the prehospital provider, patients and allied health professionals. The specialist outreach, implementation of telehealth technologies, and provision of real-time interactive video-teleconferencing (VTC) for education and specialty consultant services have improved access to healthcare specialties, prehospital education, and technologies used in the care of the rural and medically underserved patients.

Methods:

This was a descriptive, quantitative, qualitative, longitudinal study consisting of two parts: education and healthcare. The program involved all system participants (providers, patients, and students) and monitored all reported data. Anonymity was always maintained. Subjects were recruited from the classroom sites, emergency departments, and participating medical clinics. The subjects were told about the study and if they agreed to participate, were consented by the healthcare provider or instructor.

The education section of this study included prehospital healthcare providers and community populations. Ambulance stations, medical centers, and hospitals were established as education sites. The VTC systems initially selected for this protocol are the Tandberg 6000 and Polycom FX which are capable of integration by using IP and ISDN. The International Telecommunications Union required set standards for real-time multi-media communications including: H.320 (for ISDN use) and H.323 (for IP use).

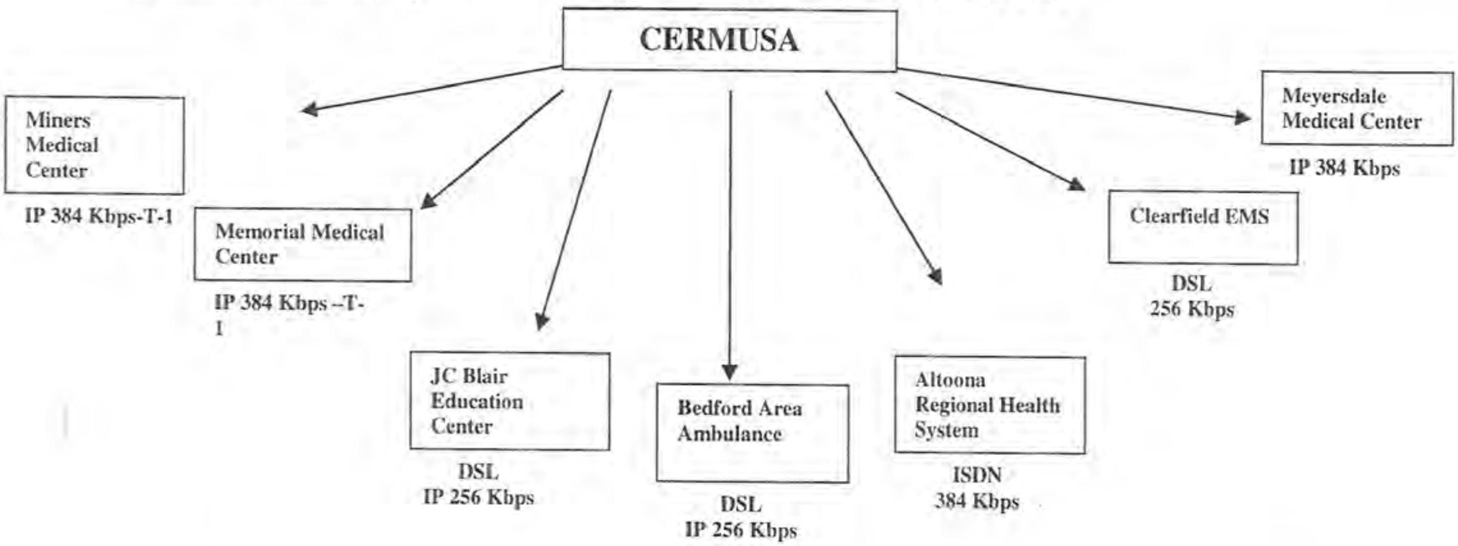
Integrated Services Digital Network (ISDN), a digital telephone service, provided rapid and accurate transmission using standard telephone lines with each line consisting of two channels of 64 kbps data transfer rate for a total of 128 kbps of bandwidth. Each ISDN line had a unique phone number assigned to each line. Depending on usage, this appeared to be an expensive option for VTC communication.

The second technology chosen was Internet Protocol (IP). The IP connectivity used for the VTC was contained within the hospital's existing infrastructure. Data was transmitted from one computer to another over the Internet.

The third type of communication exercised for the VTC connection is Digital Subscriber Line (DSL). DSL is high bandwidth transmission that uses copper telephone wire. This bandwidth is capable of transmitting 512 kbps to 6.1 mbps. A modem must also be installed at the user site to transmit the signal to the Ethernet port on the VTC device though a CAT5 or RJ-45 cable.

Finally, a multipoint control unit (MCU) was purchased which connects one Local Area Network (LAN) to another LAN using the same protocol. This MCU allows IP and ISDN sites to participate in a VTC at the same time. A maximum of eight participants can maintain a continuous presence throughout the call. All conference participants are seen at the same time. Figure 1 illustrates the communication bridge (Knee, 2007).

Communication Bridge Connectivity for Prehospital Classes (Figure 1)



Initially, a partnership was established between CERMUSA and J.C. Blair Memorial Hospital for the purpose of providing reliable and advanced communication technology for the delivery of healthcare services to individuals residing in rural and medically underserved areas. The initiation of this partnership has resulted in:

- a comprehensive "test bed" that demonstrates advanced medical information technologies that can meet the healthcare needs and requirements of the rural community effectively and efficiently
- requirements for medical information technologies and related policies and procedures which allowed the hospitals to provide extended healthcare access, services and needed education programs to their catchment areas
- identifying the telecommunication and computing technological capacity of the rural "test bed" to meet the needs of the community and its hospitals
- examination of the characteristics, concerns and networks of individual rural physicians and determined their ability to adopt new medical information technologies
- determination of the local community perceptions and the level of community trust and involvement in the local healthcare systems and are better able to understand the

consequences of technology adoption and diffusion as well as the ability of the technologies to affect the rural hospital and community viability

J. C. Blair Memorial Hospital was equipped with an advanced telecommunication telehealth system connecting the hospital with Broad Top Medical Center, Huntingdon Family Clinic, and the Altoona Regional Health System. These systems were to be used by the physicians and physician assistants and were maintained by CERMUSA technical staff. An advanced tele-radiology picture archiving and communication system (PACS) at J.C. Blair allowed physicians to evaluate diagnostic quality x-ray films in their homes or have them sent to distant reading services. However, due to an increase in the volume of testing and information storage limitations, the hospital found it necessary to replace this system with one that had a larger storage and processing capacity.

Miners Medical Center is equipped with a wireless LAN, new computer systems, a laboratory information system, pharmacy PYXIS system and resting/stress electrocardiography technology with data storage allowing the cardiologist to evaluate electrocardiograms from a distance and enter their interpretations and diagnosis to the patient's medical record. The Miners Medical Center information technology director is trained to maintain and utilize the systems located in Miners Medical Center.

Distance Education Support to Remote Individual Healthcare Providers: Prehospital
The EMS community uses videotapes and satellite broadcasts for continuing education. This allows the healthcare provider living and working far from training centers to access much needed continuing education. Currently, on-line programs and computer based studies are used frequently, giving greater flexibility and information resources to the prehospital healthcare provider.

Initial certification and continuing medical education is a valuable and essential component of assuring competent Emergency Medical Technician/Paramedic (EMT/P) licensure and or certification. The standard EMS curricula require EMS providers to be competent in terms of knowledge, skills, and professional behaviors. Competence must be assured based on initial education and outcomes. State and local protocols require the EMS provider to deliver precise, appropriate patient care on an ongoing basis. As the prehospital professional endeavors to become knowledgeable and proficient in the delivery of prehospital care, it must be realized that continuing medical education is the cornerstone of EMS practice (Prehospital Emergency Care, 2004).

The National Association of EMS educators has taken the position that recertification is and must remain an integral part of maintaining licensure for the EMS professional and should remain at the forefront of the EMS provider's plan for professional growth (National Association of EMS Educators, 2004). The knowledge and experience learned during initial training and education should be evaluated periodically for adequacy and consistency with current medical practice. The EMS professional must be held to a consistent standard of skills and knowledge. Emergency practice changes periodically in techniques, equipment and patient encounters. Recertification should measure the EMS professional's ability to react appropriately to the everyday patient encounter and must also assess his or her ability to manage unusual encounters that appear less often. Throughout EMS education, these individuals are taught to participate in refresher and continuing education to reinforce, update, and expand their knowledge and skills (National Association of EMS Educators, 2004). As part of this continuing education process the National Association of EMS Standards includes distance education as an option for delivering this education (National Association of EMS Standards, 2007).

EMS systems are community based health management organizations that are fully integrated with the overall health system, clinics, hospital, and physicians' offices within their districts. These systems allow healthcare providers to identify and provide care for acute illnesses and injuries; contribute to the care and treatment of chronic conditions, and monitor community health situations. The EMS system along with other healthcare providers and public health and safety organizations, improve community health and result in the more appropriate use of acute care and healthcare resources.

Many sponsoring agencies such as hospital and community colleges provide continuing education for the prehospital providers at little or no cost. Unfortunately, distance from these sites or small number of individuals involved in the EMS areas, makes it difficult for the crews to attend these programs in order to obtain the required continuing education. The prehospital education program provides continuing education programs and paramedic review and certification from the sponsoring site by real-time VTC to some of the smallest hospitals or ambulance stations located at a closer central site. We believe it has allowed more responders to participate without leaving their primary coverage sites, therefore saving time and money.

The prehospital community in the SAEMS accepted and welcomed our paradigm. Initial offerings of the paramedic review course and the paramedic certification class were well attended with positive feedback from students and instructors. In the beginning, some students and instructors were concerned about the technology and the mode of the virtual classroom. However, with growing exposure students offered suggestions and ways to improve the system which would work for them with different types of technologies. Past participants demonstrated the technology to be valid for providing education at a distance and made a case for use of interactive communication technologies in the education of their peers in the future.

The VTC system at Memorial Medical Center, which is used as the hub for the paramedic certification and review programs, was maintained and managed by the paramedic coordinator, who was trained and was supported by information technology at CERMUSA. The bridge, which transmits the class to the distant site, was operated by CERMUSA. Similarly, the receiving codecs at the distant sites were also maintained by CERMUSA. At the beginning of the year, a student, chosen by the paramedic coordinator at each site, was trained by CERMUSA to take care of and trouble shoot common problems associated with the VTC systems. Each selected student was provided with a laptop computer and free Internet service for the class year.

During the first two years of this study, numerous telecommunication difficulties were encountered by the information technology researchers. Initially, the sites involved in the program were connected by ISDN/T-1 communication lines which were extremely costly. Therefore a decision was made to try alternative communication modalities that were available. During the fall of 2003 and spring 2004 a commercial service was used to transmit the class contents over IP utilizing the LAN and DSL already in place. Memorial Medical Center communicated over IP to Meyersdale Medical Center and Miners Medical Center. Altoona Regional Health System's Bon Secours campus utilized ISDN (at their request) and J.C. Blair connected IP through the use of DSL. The cost of the line charges decreased but the bridging services costs were very expensive.

Because of continued difficulty, different communication modalities were used to maintain the communication connections. It remained costly to provide this service due to the amount of technical support needed and the cost of the commercial bridging service. Costs associated with course delivery included: equipment, installation of lines, monthly fees, and costs per minute of the lines. A cost analysis was completed comparing the cost of providing the class against the travel expense of the students in the first paramedic review class. According to this cost analysis, the cost of the equipment, phone charges, and technical support were not sufficiently offset by the savings of student travel expenses to make this program cost effective at that time.

Due to the expense, it was determined that another solution must be found. In the spring of 2003, CERMUSA purchased a multi-communication conferencing unit (Communication Bridge) and implemented the service for prehospital use in the fall of 2003 for the paramedic certification class. The implementation of the bridge here at Saint Francis University allowed CERMUSA to become the hub for all of the communications of the paramedic certification and review classes in SAEMS. CERMUSA called each site and the bridge connected all of the sites over IP. No local networks were involved. The calls were transmitted at 256 kbps which appeared to be adequate for classroom instruction. Memorial Medical Center and Miners Medical Center were connected over IP (through existing T-1 lines). Bedford and J.C. Blair Memorial Hospital were connected over IP through DSL, and Altoona Regional Health System was connected using an ISDN line. The use of costly ISDN lines by CERMUSA was eliminated and all the sites were effectively managed (and continue to be managed) by one technician.

Students and instructors used WebCT as a tool for handouts, chat rooms, and e-mails. This saved time and money for the sponsors and allowed students to prepare for class by downloading study material and assignments. Bridging technology was initiated from CERMUSA, allowing the entire paramedic program to be distributed real-time across IP resulting in significant cost savings to CERMUSA and the participating students.

The healthcare section of this study provided the means for medical consultations and precepting to clinicians in rural and medically underserved areas. This protocol was designed to improve accessibility to specialty consultative and precepting services to clinicians in rural areas. This project studied the impact of using telecommunications technology in providing consultative medical services to clinicians in rural and medically underserved areas. CERMUSA worked closely with the rural healthcare providers to establish the infrastructure for the telehealth project and then assisted during the ongoing endeavor.

THE VTC systems used at Broad Top, Huntingdon Family Clinic, Mount Union Medical Center, and J.C. Blair Memorial Hospital are roll-about units equipped with multiple patient assessment tools including an otoscope, ophthalmoscope, electrocardiogram, general examination camera, and oral camera. These systems:

- are standards-based, and capable of interfacing with other VTC systems that are also standards-based
- are user friendly and easy to operate
- provide communication between patient, referring clinician and consulted physician
- are capable of recording data for future viewing and evaluation
- are portable and easily moved from one area to another

The goal of the project at J.C. Blair Memorial Hospital was to study the impact of using telecommunications technology to provide consultative medical services to patients and providers in rural and medically underserved areas. The participants completed evaluation forms at the conclusion of the telemedicine consult or meeting. This form rated the technical aspects of the transmission. Those involved would then be able to document their opinions of the VTC encounter immediately following the conclusion of the session. The clinician requested information from the patient, and if the patient was unable to provide the information, then their family members could provide the information. Responses were scored on a five point Likert scale. Additional space was provided for comments on overall satisfaction, convenience, or any related issues. CERMUSA was involved in monitoring the primary communications infrastructure for this project and assistance during the ongoing project; hoping to establish a county-wide telehealth solution for specialized healthcare.

All telemedicine encounters were evaluated. Upon arrival at the clinic or hospital emergency department, the purpose of the study was explained to the patient/family. If a specialty consult was needed, an informed consent was obtained. If the individual chose not to participate in the study, medical care was provided without the telecommunications technology. At the conclusion of the visit, the evaluating clinician on site, the consulted clinician, and the patient or family member evaluated the session. The following criteria were evaluated:

- audio and video quality
- clinician comfort with VTC method of precepting
- patient satisfaction with the VTC method of consult
- hospital inpatient or outpatient
- referring physician
- consulted physician
- mileage traveled to clinic
- mileage if traveled to consulted physician
- use of medical peripheral tools
- any diagnostics performed

The type of equipment used and any technical difficulty encountered during the session was noted. Cost analysis forms were completed and data was used for a business case analysis. All expenditures and savings were tabulated and data were compiled for future use.

Results and Analysis:

CERMUSA, SAEMS, and the healthcare community have created an integrated collaborative effort between EMS providers and educators delivering necessary education to the prehospital healthcare provider at or near their point of service. Research is ongoing involving diverse communication modalities which will be valuable to the military, permitting routine and just-in-time education in all levels of military in an appropriate and cost effective manner.

Information technology has been identified as a leading means of decreasing the remoteness of rural healthcare. Through the use of the latest in information technology, this solution is improving information availability for the healthcare providers and the general public. thus assisting them to lead a healthier lifestyle. Lessons learned from this endeavor can be applied to a variety of healthcare settings. The benefit would be of particular importance to military healthcare organizations related to the frequent movement of military personnel within the military system. For military healthcare practitioners to deliver quality care, they need to have access to relevant patient information.

This study also addresses the ongoing challenge to provide all Americans with access to the highest quality of care. Use of domestic telehealth programs can set standards for the entire world. Technology such as this could be used to link frontline military personnel in active war zones to medical specialists located in facilities hundreds or even thousands of miles away. It is imperative that this technology can be applied to telehealth allowing the United States to lead the way in improving the quality and availability of care to our citizens in domestic and combat scenarios.

Key Research Accomplishments:

- Placement of wireless system throughout Miners Medical Center
- Installation of electronic classrooms at Miners Medical Center and J.C. Blair Memorial Hospital
- Implementation of Cardio-perfect electrocardiogram resting and stress systems in Miners Medical Center
- Implementation PYXIS Pharmacy system and Laboratory Information System in Miners Medical Center
- Broad Band connection with VTC capabilities of two rural clinics and J.C. Blair Memorial Hospital in Huntingdon County
- Provision of cost effective VTC capabilities for rural EMS providers in eight county areas for paramedic certification and continuing education classes
- Provision of cost effective VTC capabilities for rural patient healthcare education classes

Reportable Outcomes:

Rural Hospital Enterprise Solution and Test Bed for Rural Healthcare and Education

Healthcare providers have a responsibility to provide their customers with the best healthcare solutions available. These portions of the protocol identified ways to improve access to information for physicians, patients, and hospital personnel through the following:

- Demonstrated the ability to provide real-time, interactive communications both synchronously and asynchronously
- Patient education – monthly patient education classes covering a variety of health topics were presented via VTC to Broad Top Medical Center, Huntingdon Family Practice, and Mount Union Medical Center patients from the J.C. Blair Memorial Hospital education room

- Demonstrated the ability to transmit real-time patient assessment information through data and video transmission
- Demonstrated the ability to transmit information of clinical relevance, including digital radiology images and real-time digital images
    - o Radiology interpretations at J.C. Blair Memorial Hospital were done at a distance by the hospital radiologist and Night Hawk
- Implementation of wireless technology in a small rural hospital
- Successful implementation of a stress and resting cardiology access system in a small rural hospital with remote access for interpretation and diagnosis by physician
    - o Since the inception of the program on 11/19/2004 a total of 8,537 resting ECG's and/or exercise/stress/treadmill ECG's have been performed
- Recognized difficulties with utilization of technology by healthcare providers within the hospital and clinic settings
- Recognized the need for a champion to promote and utilize the available telehealth technology
- There have been no complaints received from participants in this portion of the study and no deviations from the study protocol have occurred
- No adverse events have occurred
- Attempts to establish a telehealth link for critical care triage between JC Blair Memorial Hospital and Altoona Regional Health System have been unsuccessful

Distance Education Support to Remote Individual Healthcare Providers: Prehospital
The prehospital healthcare provider is often the first point of contact for over 70% of emergent patients. These providers are required to earn and maintain specific certifications. Often the location of education sites makes it necessary for students to travel great distances to attend classes. Evolving emergency medical education is tasking the provider to learn new advanced skills and techniques necessary for effective and life-saving performance. This protocol has:

- Provided cost-effective distance learning program for EMS providers for paramedic certification and review classes in eight county areas in Pennsylvania
- Demonstrated the feasibility, quality, and quantity of encounters and documentation of educational requirements for certification and re-certification through VTC
- Demonstrated through testing that the prehospital healthcare provider receives the information and verified compliance with the current requirements for continuing education and training

Eighteen students were enrolled in the 2007 pre-hospital healthcare provider course (12 males and 6 females). One subject voluntarily left the program but no subjects were removed by the Principal Investigator (PI). No complaints were received from study participants, there were no deviations from the study protocol, and there were no adverse events reported. Year-to-date eleven of the students have taken the National Registry Examination and six of the eleven have passed all portions of the exam and have been certified as paramedics. Six students have not yet taken the exam. This pass rate is lower than previous years. However, this is also the first time the "Computer Adaptive Test" (CAT) has been used. The Paramedic Certification Examination is now a computer adaptive test developed by the National Registry of EMTs/Paramedics. CAT more accurately measures the competency of a candidate by using a computer algorithm that selects questions for each candidate based on how they're doing as they proceed through the exam. Each candidate takes a unique exam with questions drawn from a database of thousands of items. The exam is based entirely on the candidate's individual ability. Each candidate is given a set of starting questions. Based on their answers to those questions, the computer estimates the candidate's ability up to that point and selects the next question. Each time the candidate answers a question, the computer re-estimates their ability and selects the next question to be presented. If the paramedic student quickly shows competency by successfully answering the more difficult questions, they will receive a minimum number of questions to pass the examination (National EMS Standards, 2007).

The paramedic certification class has continued. At this time, distance learning certification and review classes are provided to eight sites in seven counties. It is apparent that until now there has been a general trend suggesting the utility of these efforts. Although all the data has not yet been collected for this year, we believe the trend will continue. The tables below illustrate the Pass Fail Rates from 2002 to 2005. No data was collected in 2006 related to IRB issues and final test results for all 2007 participants are not yet completely analyzed. The tables below illustrate the status of the program:

- Table 1 – Pass Fail Rates on Written Examination 2002 – 2005
- Table 2 – Pass Fail Rates on Practical Examination 2002 – 2005
- Table 3 – First Time Pass Rate Comparison National Registry vs. SAEMS

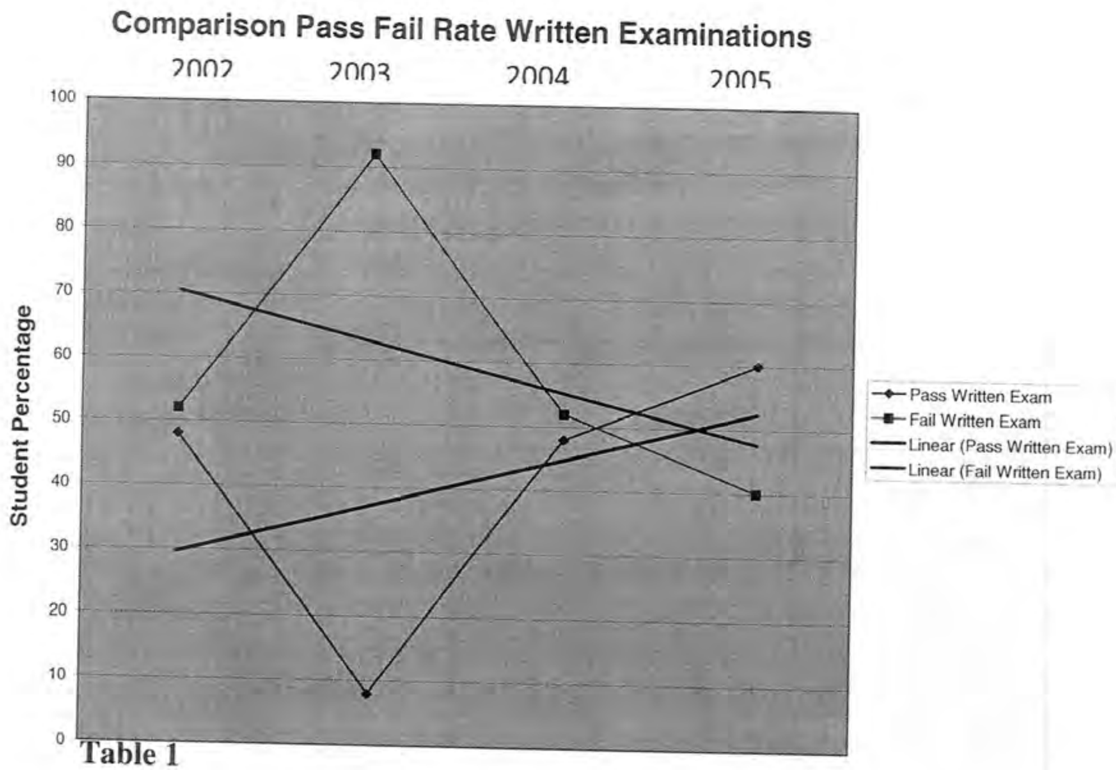


Table 1

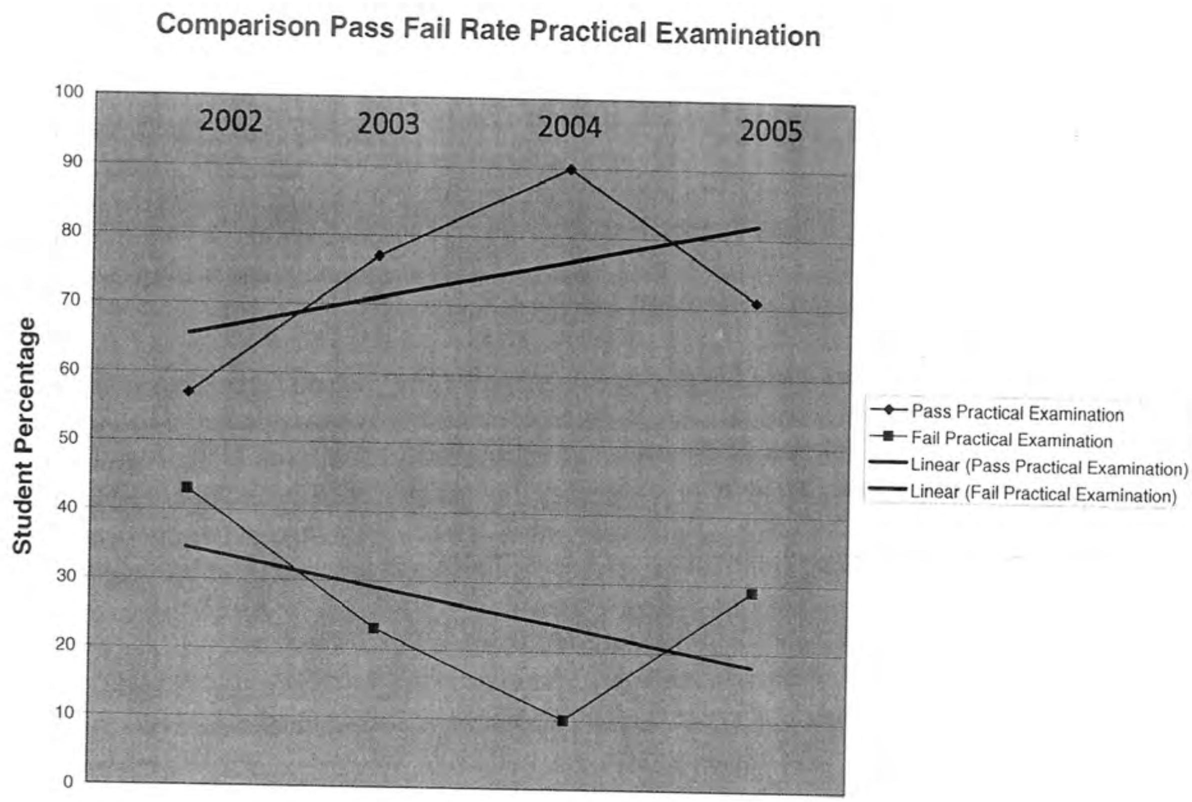


Table 2

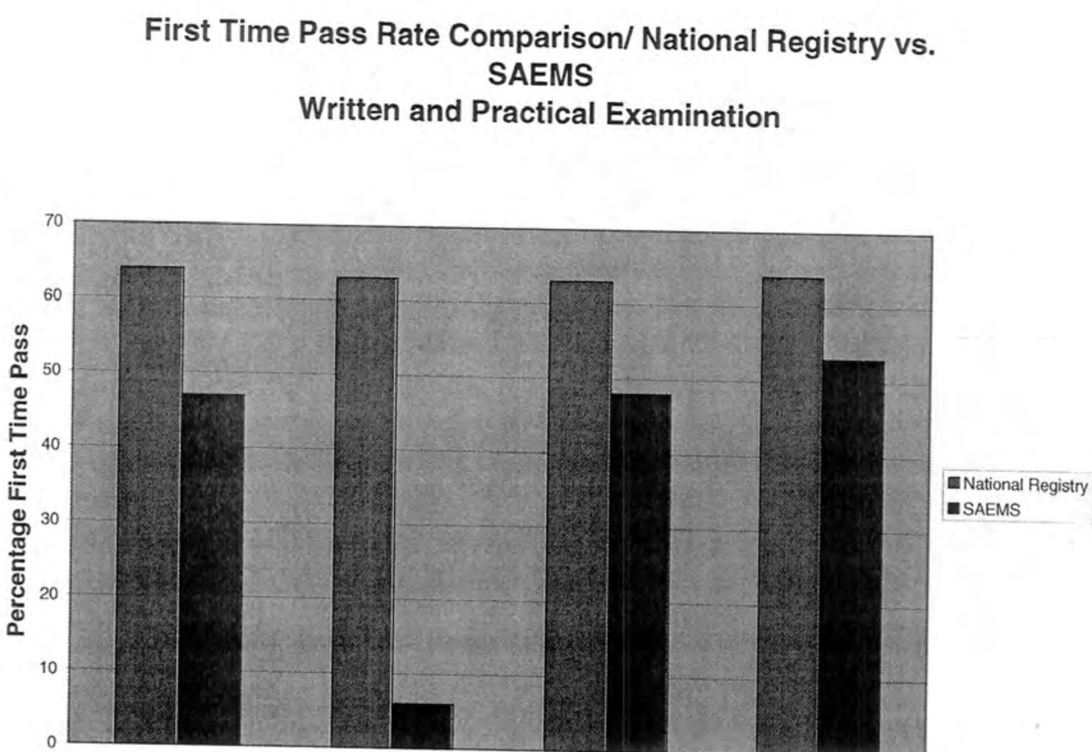


Table 3

Conclusions:

Past experience suggests that large scale distance learning efforts increases the likelihood of failure mainly due to lack of a student acceptance, low enrollment, increased use of faculty and higher costs. Some students miss the social structure and lack of interaction with faculty and other students can decrease motivation and responsibility (Update, 2002). It is conceivable that the students feel isolated, lose interest over time, experience frustration and a number of other emotions. It is apparent that self motivation is important for success. Self-directed education requires certain support to facilitate learning which should be based on the needs of the student.

However, the paramedic certification program has changed drastically during the past five years. The implementation of VTC using IP has decreased the communication costs. Students and faculty have become more comfortable with the technology. Real-time distance education for paramedic certification has great potential and can provide a rich study environment for a student. The program has become successful and sustainable. The paramedic certification and review programs are serving an unmet need for the rural area because it has provided specific training to the student who otherwise may not be able to obtain this education. We feel that this study provides an opportunity for people in under-served counties such as Somerset, Blair, Cambria, Centre, Huntingdon, and Fulton to obtain training to become certified paramedics. The EMS system along with other healthcare providers and public health and safety organizations could improve community health and result in the more appropriate use of acute care and healthcare resources. In addition, the cost of the EMS program is usually less than college tuition and could be finished in a year. Table 4 illustrates paramedic student enrollment and retention in the prehospital program from 2000 to 2007.

Paramedic Student Numbers 2000 – 2007: Table 4 (*lost to active duty)

Class	Enrollment	Retention	Withdrew
2000	24	16	8
2001	18	16	2
2002	34	20	14
2003	23	17	5
2004	29	21	8 *
2005	28	17	11 *
2006	**No Data collected related**	**to IRB Issues**	
2007	18	17	1

Despite the training and revisions carried out for practitioners at J.C. Blair Memorial Hospital, Broad Top Medical Center, and Huntingdon Family Clinic, the use of telehealth technology has been less than favorable. The two clinics use the VTC for board meetings but have not consistently done any physician assistant mentoring or specialty consults with the patient population. The hospital has not done any significant specialty consults either. The project has not worked as expected. The cause is probably multifaceted. It appears that the clinicians found the technology difficult to integrate into their practice on a daily basis. The practical and logistical difficulties encountered with these systems apparently became a huge barrier to the practitioners causing them to lose their clinical flexibility. Complexity of the telehealth system can exist at four separate levels. They include:

- implementation of the service
- adoption of the service by the practitioner
- bringing telehealth technology into everyday practice
- development of new procedures to accommodate the new telehealth technologies

A breakdown in any of these levels can lead to program failure. The clinicians must develop an ownership of the program, be flexible in integrating the technology into their practice so that it ceases to become a special service and instead becomes a necessity similar to the telephone, facsimile, and computer. Normalization of telehealth as an everyday tool must occur.

We are becoming more dependent on this technology and as researchers, we must become more cautious in designing protocols and projects that use new technology. The prehospital education portion of this protocol has been a resounding success while other segments of the protocol have shown a slower progression. We would hope that in discussing the lessons learned through this project, we can turn the failures into a success story.

During 2006, the IRB approval was not received until the latter part of the year. As a result, data were not collected. We wanted to show that the continual trend of the usefulness of these technologies in the rural setting, especially for the paramedic certification program. Suffice to say that we have no doubt that if we were able to collect data points, this trend would have continued.

Test Bed for Rural Healthcare and Education has met its goals of bringing telemedicine to the grassroots level and demystifying it for persons who are unfamiliar or uninformed with this approach. Even though the development of specialty healthcare services and healthcare education for rural populations can be difficult, CERMUSA and its partners have been able to put these services and educational opportunities in place. The implementation of telehealth technology has provided access to healthcare specialists and real-time interactive video-teleconferencing (VTC) has become an avenue for providing pre-hospital healthcare provider and patient education classes. This program has been successful because it has taken medicine and education beyond the traditional exam room and classroom walls, created a network of practitioners that develop and present programs, and has made patients and practitioners active participants in treatment and education.

Table 6 illustrates the patient health education classes that were presented from the J.C. Blair Memorial Hospital Education room in 2007.

Class Topic	# of Attendees	Completed evaluations	Incomplete evaluations
Asthma	8	8	0
CHF	12	11	1
Diabetes	13	13	0
Influenza	0	0	0

Table 6

Knowledge of hospital infrastructure and the experience gleaned from working with our partners provides a solid basis for moving out into the rest of the isolated rural areas surrounding CERMUSA. We plan to expand the research from established sites to other healthcare clinics, private practices, and homes through wired and wireless telecommunication systems and telehealth technologies. This includes healthcare applications and wellness programs.

CERMUSA and Saint Francis University continue to collaborate with our local partners to provide modern, high quality healthcare, healthcare education and specialty healthcare services to the rural and medically underserved populations in several counties. These partnerships were developed to explore the feasibility, reliability, and the impact of advanced communications and technology and to compare, contrast, and analyze the types of technologies needed to meet the requirements of the community and its healthcare providers (Rae. 2003). CERMUSA continues to support, monitor, and expand the educational and healthcare test bed demonstrating the ability for new medical information technologies to meet the healthcare needs and requirements of the rural population.

Telehealth is an integrated system carrying out healthcare activities at a distance and is increasingly used in an effort to provide high quality, cost-effective care at home (Marineau, 2005). Families are expected to provide more complex care to ill family members. As a result, telehealth may become an essential tool in assisting families in transitioning their loved ones from illness to health in the future. Additional research is needed to identify patients who would be good candidates for telehealth in the acute care arena in place of hospitalization. This will contribute significantly to the healthcare industry in offering potentially cost-effective measures in delivering necessary care to a growing aging population.

Smith (2005) studied a relationship between financial factors and the deployment of telemedicine. The urban and rural populations desire to be near medical facilities, but that is not always possible. Demographics of our population are changing and people are living longer. Elderly, sick, and uninsured make up a large part of the population, many who have no mode of transportation. Five financial indicators are important: initial or capital investment, operating or ongoing costs, profitability or net income, cash flow, and reimbursement. Reimbursement appeared to be the largest barrier to widespread deployment of telemedicine. The results led to a conclusion that financial indicators do play a major role in decisions related to deployment of telemedicine projects, like many other healthcare projects. Telemedicine is not the sole cure for the rural health dilemma; it can be a major ingredient if aggressively deployed. Providers can use the available technologies and organizations options available and provide specialty care at a reasonable cost (Smith, 2005).

Buckwalter, et al., have shown that telehealth can play a major role for the rural elderly and their caregivers. "Technology-based delivery methods such as videophones and one and two-way interactive computer networks are envisioned as contributors for improving rural residents' access to services, individualizing rural healthcare, increasing rural health practitioners' continuing education opportunities, and improving quality and cost-efficiency of care." Rural areas present unique challenges that make service delivery difficult. These challenges include poverty, isolation, difficulties with transportation, sparse and scattered population and too few human service agencies, trained professionals and healthcare resources. In order to be successful, service providers should offer rural caregivers better coordination of services, improved communication among local agencies, consistent relationships with providers they trust and improved access to healthcare information (Buckwalter, et al, 2002).

Protocol Changes and Future Endeavors:

- Telemedicine equipment has been removed from J.C. Blair Memorial Hospital Emergency Department and Altoona Regional Emergency Department due to lack of usage
- Radiology system at J.C. Blair Memorial Hospital was replaced by the hospital due to the need for greater storage capacity on the system
- Mount Union Medical Center was added to the protocol in the year 2007
- Education classes were presented from the J.C. Blair Memorial Hospital Education Room to Mount Union and Broad Top Medical Centers and covered the topics of congestive heart failure, asthma, and diabetes
- Patient education class calendar for the J.C. Blair education room is being developed for 2008 and classes will resume in March of 2008
- Memorial Medical Center will be providing allied health education classes to Miners Medical Center staff beginning in April 2008
- CERMUSA continues to work with community organizations in the development of rural health initiatives
- At the end of this funding year pre-hospital classes will no longer be part of the protocol
- Teleconferencing equipment was moved from Huntingdon Family Practice to Mount Union Medical Center to facilitate their participation in the patient education classes

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Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Improving Wound Care Management Through Video Teleconferencing

Protocol No.: 05-TATTH210-05

Date: March 12, 2008

Protocol Title: Improving Wound Care Management Through Video Teleconferencing

Principal Investigator: Gina L. Litzinger, RN, MSN

Protocol Executive Summary:

The Improving Wound Care Management Through Video Teleconferencing research study provided solutions to overcome the growing number of chronic wounds coupled with the shortage of specialized wound care nurses. CERMUSA researchers developed a wound care consultation system designed to conduct real-time remote wound examinations and follow-ups via VTC using standard analog phone lines, thus making it possible to conduct these visits virtually anywhere there is a phone line. The wound care nurse at Home Nursing Agency viewed wounds remotely from her office, while videographers traveled to the patient's home. This allowed the wound care nurse to see multiple patients, develop treatment plans, and consult with related professionals. Due to the real-time nature of the wound care visits, patients and their respective caregivers had the opportunity to ask questions and receive education from the wound care nurse. To date, wound care nurses conducted 286 virtual visits within the population base of 49 patients, resulting in 5,933 miles of travel saved (approx. $2,136), and 213.5 hours of time saved (approx. $5,765). This solution helped offset the barriers of travel for the patient, especially those too ill to travel. In addition to providing improved assessment and treatment of chronic wounds, patients experienced improvements in wound healing, and Home Nursing Agency experienced time and money savings for their organization.

Introduction:

Today, the chronic wounds of five million patients in the United States account for $2.8 billion dollars in healthcare expenditures. Further adding to the problem is the shortage of Wound Ostomy Continence Nurses needed to properly monitor these wounds to achieve healing. These substantial costs and shortages of trained professionals have encouraged the home health community to evaluate techniques and processes being used to properly monitor and manage chronic wounds. Developments in video teleconferencing (VTC) technologies have provided the home healthcare industry with the opportunity to view high quality, high definition pictures from a distance.

Healing wounds at home costs approximately $13,000 per treatment episode (DiCianni & Kobza, 2002). Chronic wounds are also responsible for 50-70% of amputations, resulting in billions of dollars in healthcare costs (Visco, et al, 2001). Depending on the level of amputation, the costs for lower-extremity amputations approaches $30,000-$33,500 (Tennvall & Apelqvist, 2004). Unfortunately the shortage of Wound Ostomy Continence (WOC) Nurses is reaching a point of national crisis, forcing WOC Nurses to manage disproportionately heavy caseloads (DiCianni & Kozba, 2002).

Effective and timely management of chronic wounds can significantly delay or eliminate the need for limb amputations and surgical interventions, significantly reduce hospital admissions and substantially reduce costs related to care. Proper management of chronic wounds requires frequent, routine monitoring for wound healing progress to optimize healing and ensure early recognition of impending complications (Gardner, Frantz, et al. 2001). The development and implementation of wound treatment plans depend on adequate wound assessments, as well as the patient and its support structure. Frequent wound assessments by a wound care specialist may help the specialist to adapt treatment strategies to accommodate changes in the wound status that otherwise would not be identified.

Managing chronic wounds should include education on wound care management and nutrition because it could reduce or eliminate the risk of infection, ensure proper dietary requirements for wound healing, and instruct the patient and caregiver(s) when to seek medical intervention. Timely institution of prophylactic and corrective measures in wound care management can help prevent or slow the progression of pressure ulcers, thus improve the quality of the patient's life while minimizing use of healthcare resources (Dharmarajan, T., & Ahmed, S., 2003).

CERMUSA partnered with HNA due to the location of offices in Center, Cambria, Bedford, Blair, Huntingdon, Franklin and Fulton counties, and its extended coverage in parts of nine additional counties. One WOC Nurse serves these areas by traveling across this region to evaluate wounds. Due to considerable travel time, the WOC Nurse was idle and unable to evaluate wounds, therefore leading to inefficiencies and extended service costs. The design of this protocol helped minimize idle time. Evaluation of severe wounds using video teleconferencing equipment and advanced camera technology allowed the WOC Nurse to conduct wound evaluations at a distance, resulting in decreased travel.
The protocol gave insight to the benefits of pursuing video teleconferencing as an adequate means of providing specialized wound consultations. A similar study established that remotely based nurses could access nursing expertise to improve patient care by interacting with the wound care specialist resulting in improved assessment skills (Gardner, Frantz, et al. 2001).

Military Significance:
Management of wounds sustained during military operations offers challenges that are different from treating comparable civilian wounds. Immediate wound care in the battlefield is normally not available and could be delayed for many hours. Injured military personnel are often quickly transported to the nearest field hospital, but this may also take many hours until they reach the hospital. Traditionally, military medics take medical education classes, then practice basic and advanced diagnostic and treatment skills on mannequins and each other. Classroom skills don't easily transfer to the field environment, and in many cases, medics may have limited resources or face unusual problems not traditionally seen in a hospital. The application of information technologies allows military medical professionals to provide specialized consultation services to injured military personal on the field and to the returning wounded soldiers without requiring any additional travel. The implementation of this research protocol would allow soldiers in need of wound care to receive timely, appropriate assessment and evaluation to expedite the treatment of wounds. This would improve the safety of military clinicians treating battlefield injuries, and would also support the reunions of returning wounded with their families.

Public Purpose:
Rural and medically underserved areas need improvements in wound assessment, treatment, and evaluation techniques to offset barriers such as inclement weather and tedious travel to clinicians. Improvements in assessing, treating, and evaluating wound care through video teleconference may improve medical outcomes for patients suffering from chronic wounds, improve the quality of life for these patients, and diminish the economic impact of chronic

wounds on an already overburdened healthcare system. Secondary outcomes such as non-traumatic amputations may be prevented, while widespread use of this protocol could diminish costs for third party payers such as Medicare.

Methods:

The wound care protocol explored the feasibility of conducting wound evaluations through the use of VTC technology. CERMUSA assessed the effects of new processes and technology on the costs associated with providing wound consultation, and evaluated the productivity and efficiency of WOC Nurses. Lastly, the study strived to find a sustainable solution to improve patient outcomes.

HNA administration selected healthcare staff participants for this study. CERMUSA trained participating staff members how to handle the equipment and on the policies and procedures drawn by HNA. After training, the three selected locations (Altoona, Ebensburg, and Roaring Springs) performed in-house mock wound care visits before conducting actual patient visits.

Evaluation of patients referred to HNA for care, as well as existing patients of the nursing service with Stage III and IV pressure ulcers, complex, and/or infected wounds, occurred for participation in the study. Nurses completed request for wound video visit forms. After identification of a client with a Stage III or Stage IV pressure ulcer, complex, and/or infected wound, HNA staff requested a doctor's order for this patient to participate in the study. Doctors also referred their patients directly. Additionally, other wounds identified by the WOC Nurse were accepted into the program. Supervisor or case managers also referred patient candidates for the wound video program by completing a request for wound video visit referral form.

Patient participation in this study required a doctor's referral. HNA staff registered nurses (RN) discussed this study with the patient during a routine home visit. Nurses informed the patient of the benefits, risks, and discomforts of the current research study, and read the consent to the patient to ensure patient understanding of the study. HNA nursing staff and the willing patient signed and dated the informed consent form after addressing concerns of the potential patient. In addition to the informed consent, participants also signed an Audio/Video/Photo Consent to Participate form. In several instances a patient could not sign the informed consent. In these cases, HNA staff read and described the informed consent and project description to the patient's relative or representative (advocate) who holds the Power of Attorney (POA) for the patient. The POA signed the consent form for the patient to participate in this study.

How the Video Visit Worked:

1. Video wound visits occurred on a specific schedule (Monday through Friday) during the patient's scheduled dressing change. Subjects were informed of visit dates and times. The video portion of the visit took no more than 30 minutes to complete, and did not include the time needed for the dressing change.
2. HNA videographer came to the patient's house and set up the equipment needed to conduct the visit. The equipment was not be left in the patient's home after the visit.
3. Once the equipment was set up, the HNA staff called the remote WOC Nurse to verify that this person is the correct patient for this visit.

4. After verification, HNA staff might have taken the patient's blood pressure, pulse, respirations and temperature (if requested by the wound care specialist). The patient was also asked about their plan of care and any lifestyle changes they were making to help with the healing of their wound. In addition, the patient was asked about any symptoms or concerns that they have.
5. Next, the wound care provider removed the dressing so the HNA staff could view the wound.
6. The HNA staff looked at the patient's wound through the camcorder. Using the camcorder for viewing allowed the WOC Nurse at the remote end to see this wound. Since the WOC Nurse at the remote end was able to view the patient's wound, they were able to direct the HNA staff at taking pictures of this wound. During this time, only pictures were being taken, not video. Later, these pictures were printed and became a part of the patient's clinical record at HNA.
7. During this time, the patient heard what the WOC Nurse said about their wound. The patient also had the opportunity to speak to the WOC Nurse about any questions or concerns that they had.
8. After addressing all questions/concerns and obtaining the appropriate pictures, HNA staff ended the video call.
9. The person responsible for wound care proceeded with the patient's dressing change.
10. At this time, HNA staff collected the equipment they brought with them. Once the equipment was gathered, the HNA staff exited the patient's home.
11. When this HNA staff member arrived back at their office, they gave the WOC Nurse the memory card that contained pictures of the patient's wound. This WOC Nurse printed these pictures and placed them in the patient's clinical record.
12. Both the HNA staff member that was in the patient's home and the WOC Nurse completed notes in the patient's clinical record relating to the visit. The WOC Nurse forwarded recommendations regarding the patient's wound to the patient's physician and Case Manager.
13. The WOC Nurse scheduled any needed follow-ups.
14. Patient's completed a short survey regarding their thoughts on this type of wound care visit after being discharged from the wound video visit program.
15. HNA staff members participating in this study completed surveys pertaining to this type of wound care.
16. HNA administrative staff also completed surveys regarding their overall impression of this type of wound consultation and the impact it had on the organization.

Issues and Resolutions

Throughout the course of the FY06 study, multiple issues occurred, mainly technical issues with the wound care kits. At times it was difficult to determine if the issue was a technical or human error. Staff at HNA encountered knowledge retention issues pertaining to the use of the wound care kits, resulting in various user issues. In an effort to decrease retention issues, staff at CERMUSA retrained the videographers and WOCN on the use of the study equipment. CERMUSA also scheduled sessions for practice video calls into the CERMUSA test-lab. Staff at HNA also practiced in-house mock wound care assessment to increase familiarity of the wound care video kits.

Battery Charging
One issue pertained to the insufficient charging of the battery for the camcorder. CERMUSA determined that the camcorder in the kit was improperly plugged in. Staff at CERMUSA resolved this issue and reinforced the use of the wound care user manuals for initial troubleshooting.

Disconnected Cables
Issues involving the disconnection of cables presented itself as a common theme pertaining to technical issues. To resolve this issue, staff at CERMUSA reinforced the cables in the wound care kits with zip ties, soldiering, tape, and glue. Although this helped to reduce the number of technical issues with the kits pertaining to disconnected cables, this remains an ongoing issue.

Memory Card Issues
Several times throughout the study, staff at HNA experienced issues with the memory cards for the camcorders. One memory card failed to capture pictures. Upon investigation, CERMUSA determined that the memory card became locked. CERMUSA unlocked the card and informed staff at HNA to check this first on the card if failure to capture pictures becomes a problem. A second memory card also failed to function properly. CERMUSA determined this memory card appeared to be smashed in the corner. CERMUSA reminded HNA of proper care and usage guidelines of the study equipment. No further memory card issues occurred throughout the rest of the FY06 study.

Printing Images
Two months into the FY06 study, staff at HNA failed to print wound pictures. This resulted in drying up the ink in both printers. In addition, the wound care nurse cleaned the printer cartridge area with alcohol wipes, and ruined the printer cartridge sensors. CERMUSA replaced both printers.

Deleting Images
Staff at HNA experienced difficulties deleting images from the memory cards and computer. This occurred by trying to improperly delete file path locations and directories. Staff at CERMUSA retrained the wound care nurse on the proper sequence of obtaining pictures from the memory card, storing them on the computer, and deleting them from the card and the computer when necessary. Since the retraining, no new deleting issues have occurred.

Broken Equipment
CERMUSA replaced videophones, various cables, and speakers in the wound care kits throughout the course this study. A button on one videophone became lodged. CERMUSA was unable to repair this phone and provided HNA with a different videophone instead. This same issue occurred later on in the study. CERMUSA also replaced this phone. Issues with the phones and cables remain.

Results and Analysis:

A cost-benefit analysis was conducted on results documented on tracking forms. To date, wound care nurses conducted 286 virtual visits within the population base of 49 patients, resulting in 5,933 miles of travel saved (approx. $2,136), and 213.5 hours of time saved (approx.

$5,765).Results from this study proved the hypothesis to be correct. This protocol will continue in FY07.

Key Research Accomplishments:

- Wound care study equipment installed in the Altoona, Ebensburg, and Roaring Springs HNA offices.
- Study personnel at HNA trained on the use of the study equipment.
- HNA recruitment of study participants.
- Educational sessions regarding the availability of this project were conducted at HNA for the agency staff.

Reportable Outcomes:

HNA surpassed the required patient enrollment of 30, with total overall enrollment of 49 patients.

Conclusions:

Due to HNA's unfamiliarity with research processes and procedures, there were numerous delays with the implementation of this research process. Additionally, scheduling conflicts and caseloads contributed to the delayed implementation of this study. Once HNA began to fully implement the study, patient enrollment increased. Technical issues with the equipment remain.

Rural and medically underserved areas are in need of improvements in wound assessment, treatment, and evaluation techniques to offset barriers such as inclement weather and tedious travel to clinicians. Improvements in assessing, treating, and evaluating wound care through video teleconference may improve medical outcomes for patients suffering from chronic wounds, improve the quality of life for these patients, and diminish the economic impact of chronic wounds on an already overburdened healthcare system. Secondary outcomes such as non-traumatic amputations may be prevented, while widespread use of this protocol would diminish costs for third party payers such as Medicare.

Prior to this research study, the HNA conducted wound care consultation by sending WOC Nurses to the patient's home in a traditional house-call fashion. Using traditional wound care consultation methods, WOC Nurses were only able to see several patients a day. Patients seeking wound care specialist consults were only seen several times a month. Using this wound video program, patients could potentially be seen daily by the WOC Nurse, allowing for increased wound care assessment and intervention.

This study continued partnership CERMUSA created with HNA. Although this study was in the second fiscal year at HNA, CERMUSA researchers and HNA administrators continued to examine outcomes from the prior wound care study to aid in determining future phases of this project. There was mutual agreement between CERMUSA and HNA to continue research focusing on patient outcomes using a standardized wound assessment tool combined with nursing best practices and VTC visits. CERMUSA and HNA are seeking to determine how the healing times for chronic wounds treated via conventional wound care practices compare with wound care healing times utilizing telemedicine applications.

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Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Utilizing Telehealth to Support School Nursing Services in Obesity Prevention

Protocol No.: 06-TATTH223-06

Date: March 12, 2008

Protocol Title: Utilizing Telehealth to Support School Nursing Services in Obesity Prevention

Principal Investigator: Camille Wendekier, CRRN, MSN

Protocol Executive Summary:

Since the mid 1970's the obesity rates for children ages six to eleven rose from 6.5% to 18.8%, while the rates for children ages 12 to 19 increased from 5% to 17.4% (Center for Disease Control and Prevention [CDC], 2007a). Obesity raises the risk of developing many diseases including diabetes, cardiovascular disease, hypertension, stroke, osteoarthritis, and cancer (CDC, 2007a).

Although there are many evidenced-based curriculums on the prevention of obesity available for elementary and junior high school students, there are little, if any, resources available for high school students in the prevention of obesity. This research protocol utilized telehealth applications to supplement school nursing services to provide education on nutrition and activity to ninth grade students at Cambria Heights High School. Ninth grade students in Penn Cambria High School acted as control subjects.

The curriculum was delivered to the students through live synchronous classes. Guest speakers were integrated into the curriculum periodically through distant learning technologies. Video teleconference technologies were used to provide these synchronous learning experiences through existing Internet communications.

The students' cognitive knowledge was evaluated through pre- and post-examinations. Additionally, the effects of this course curriculum on student health will be evidenced in BMI changes, absentee rates, and number of visits to the school nurse.

Introduction:

Approximately 72 million adults living in the United States are obese (Ogden, Carroll, McDowell, and Flegal, 2007). Although politicians, public health officials, and healthcare providers have known the alarming increased incidence of obesity and its associated risks, American adults did not demonstrate any significant changes in the prevalence in obesity between 2003-2004 and 2005-2006 (Ogden et. al., 2007). Obesity raises the risk of developing many diseases including diabetes, cardiovascular disease, hypertension, stroke, osteoarthritis, and cancer (CDC, 2007a). Overweight children have a higher risk of becoming overweight or obese adults (CDC, 2007b). Subsequently, these children are at a higher risk of developing the aforementioned conditions associated with obesity. The prevalence of the overweight drastically escalated from 1963-70 to 1999-2002. The rates for children age six to eleven rose from 6.5% to 18.8%, while the rates for children ages 12 to 19 increased from 5% to 17.4% (CDC, 2007a).

Media has become a significant public health issue in that it has a very strong influence on children's health by promoting inactivity and the endorsement of foods with little or no nutritional value (Christakis and Zimmerman, 2006). These convoluted messages regarding activity and nutrition coupled with barriers to increasing activity present an environment which promotes weight gain and obesity. These barriers may also include lack of sidewalks, high crime neighborhoods, lack of playground equipment, and isolation from peers in rural areas.

The epidemic of inactivity, promoted with the advent of television and video games, has a profound direct effect on the pandemic incidence of childhood obesity. The "America on the Move" study, as reported in *Fitness & Wellness Business Week,* indicated that children can prevent weight gain by making minor adjustments in their lifestyle. Over a period of six months, 67% of the families in the intervention group reported that their children reduced or maintained their Body Mass Index (BMI) by reducing their daily caloric intake by 100 calories and increasing their physical activity by 2000 steps daily (Childhood obesity; overweight children, 2006).

The presence of excess weight in children and adolescents may cause the development of secondary diseases and conditions that will adversely affect the quality of life for these children in addition to perpetuating the cycle of inactivity and weight gain. For example, Taylor et al. (2006) reported skeletal fractures, musculoskeletal discomforts, impaired mobility, and lower extremity malalignment were more prevalent in overweight subjects than those reporting normal weights. Subsequently, the overweight children are at an increased risk for additional weight gain and development of conditions such as Type 2 diabetes. These secondary conditions of obesity further predispose overweight children to develop diseases such as hypertension, heart disease, and cancer.

Preadolescents and adolescents have been identified as having increased risk of having low levels of activity, thus increasing their risk of weight gain (McCambridge, et al., 2006). Although there are many evidenced based curriculums available for elementary and junior high school students, there are little, if any, resources available for high school students in the prevention of obesity. This research study utilized telehealth applications to supplement school nursing services in the prevention of obesity in ninth grade students.

The purpose of this study is to provide an integrated approach for utilization of school wellness resources to promote healthy eating and physical activity. This is accomplished by developing and implementing an educational program that complements environmental strategies within the school district.

Hypothesis:

The use of telehealth education via distance learning technologies and a learning management system to provide an activity and nutrition curriculum to ninth grade students will result in improved health as evidenced by prevention of weight gain, decreased absenteeism, and decreased number of visits to the school health office.

Objectives:

- Assess the feasibility and acceptability of a wellness program, a nutrition and activity program, implemented in the 9^{th} grade curriculum
- Evaluate differences in BMI for participants in the program

- Evaluate the number of school nurse visits for participants in the wellness program
- Examine the cognitive effects of the educational program on the participants
- Evaluate the use of virtual classroom software in delivering the program
- Evaluate the use of a learning management system (LMS) in distributing course content and assessments

Methods:

A letter describing the wellness program was distributed to all eighth grade students in both schools in May 2007 (refer to attachment). The letter, containing contact information for the Principal Investigator (PI), encouraged the parents/legal guardians to speak to the PI regarding any questions and or concerns with the study. The study objectives, methodology, and subject rights and welfare was reviewed with the Cambria Heights students and their parents at ninth grade orientation, the following August. The researchers were not able to attend freshman orientation at Penn Cambria due to confusion regarding the date of orientation. Administrators at Penn Cambria asked the researcher to attend other school functions such as open house at the high school. The researchers answered any questions the students and/or parents had at these events. Parental informed consent and student assent were obtained at these events. Because many of the parents were unable to attend the aforementioned events, both school districts elected to send informed consents home to these parents.

Study Population Criteria:

Inclusion Criteria:

- Participants must be a ninth grade student of Cambria Heights School District or Penn Cambria School District
- Participants must be able to use a computer independently
- Participants must be able to provide informed consent
- Parental consent must be obtained for every participant

Exclusion Criteria:

- Anyone who is not a student of Cambria Heights School District or Penn Cambria School District
- Any student who is unable to use a computer independently
- Any student of Cambria Heights School District or Penn Cambria School District who is not in ninth grade
- Any participant who does not have parental consent

Confidentiality methods were addressed in the informed consent, HIPAA authorization form, and student assent forms. Every participant was assigned a participant number by the associate researcher, the school nurse. At Cambria Heights, a coding system was used to give the students a four digit anonymous participant number based on when the student participated in the nine week curriculum. The first character in the participant number was a letter based on when the student will participate in the nine week curriculum (A – First Marking Period, B – Second Marking Period, C – Third Marking Period). This letter will be followed by a three digit number which corresponded with a randomly pulled student number. Since the students at Penn Cambria will not be participating in the nine week curriculum, they received general random numbers. CERMUSA did not have access to any documents linking identifying information to participant numbers.

Every ninth grade student at Cambria Heights School District participated in the wellness program for nine weeks (one district marking period). Only the data from those students who met the inclusion criteria will be used in data analysis. Due to schedule conflicts, Cambria Heights High School administrators elected to have the freshman students receive the wellness curriculum the first three marking periods instead of all four marking periods as originally proposed.

All computer interactions are being submitted in a password protected environment to a secured web server, where subjects are permitted to select and change their passwords. Study participants completed course surveys and cognitive assessments in a proctored environment.

- Course content is being delivered through live lectures and classroom activities.
- Guest lectures are delivered to the students through video teleconference (VTC).
- Assessments and course assignments are delivered through a learning management system (LMS). Assessment results and grades are captured within the LMS as well.
- Course lectures are captured and made available as streaming media files. These files are accessible on the LMS. Students may view any missed content or review material as they deem necessary.

The study participants were asked that:

- At the beginning and end of the school year, the students' heights and weights are recorded.
- The ninth grade students at Cambria Heights School District participated in the Wellness Program. The curriculum addresses Pennsylvania Academic Standards for Health, Safety, and Physical Education.
    - Heights and weights are recorded at the beginning and end of the academic year for all study participants. A change of protocol was submitted eliminating the measurement of height and weight during the academic year for Cambria Heights students at the request of the school nurse. The school nurse was concerned that the short time frame would not yield any significant data and that the weights may cause unnecessary stress for students.
    - The students were divided into groups to participate in the wellness program during one of the first three marking periods. When participating in the wellness program:
        - The students take a pre-test to determine their prior knowledge of the content.
        - Next, the students participate in the nine week wellness curriculum.
        - At the end of the marking period, the student take the post-test.
    - A chart depicting the Cambria Heights School District students participation is shown below:

	FIRST MARKING PERIOD						SECOND MARKING PERIOD				
GROUP A	BMI	PRE	T	POST	S	GROUP A					S
GROUP B	BMI				S	GROUP B		PRE	T	POST	S
GROUP C	BMI				S	GROUP C					S
	THIRD MARKING PERIOD						FOURTH MARKING PERIOD				
GROUP A					S	GROUP A				BMI	S
GROUP B					S	GROUP B				BMI	S
GROUP C		PRE	T	POST	S	GROUP C				BMI	S

Table Key: T - Treatment, S - Survey (Affective), PRE - Pre-test, POST – Post-test, BMI – Body Mass Index

- The ninth grade students at Penn Cambria School District did not participate in the Wellness Program, but took the affective survey and the Modifiable Activity Questionnaire (MAQ) at the beginning and end of the school year. Both surveys are attached.
- The students in the intervention group completed the affective survey and MAQ on wellness and nutrition at the beginning of the school year, at the beginning of the program, at the end of the program, and at the end of the school year.

School nurse visits will be tabulated for all participants for the length of the school year. Absentee rates will also be tabulated throughout the academic year for the participants.

Results and Analysis:

Although the school nurses (associate researchers) are currently collecting data, this information will not be submitted to CERMUSA until protocol execution is complete. Once the academic year is completed, data analysis will begin.

Student results on the assessments will be entered into an Excel spreadsheet for record collecting purposes and statistical software such as MiniTab and SPSS (Statistical Package for the Social Sciences) will be utilized to analyze the resulting data. Using these statistical packages, graphical and numerical descriptive statistical methods will be employed to accurately depict and explain the collected results. Furthermore, to detect statistical evidence connected to the study hypotheses, a set of one-way ANOVA statistical tests will be performed. These tests will analyze the difference of scores, where difference is the post-test score minus the pre-test score.

Key Research Accomplishments:

This research strives to serve as a template to provide lifestyle education to remote populations. For example, the delivery of youth obesity prevention programs to military families may yield several benefits to the family unit and the Department of Defense. First, the ability to prevent the secondary conditions associated with obesity not only will improve the quality of life for these families, but also will save economic and healthcare resources that would otherwise be used to treat these conditions. Secondly, the use of telehealth applications in the school setting for the provision of these programs will expose the children to resources and content expert education despite where the families are deployed. Finally, the use of telehealth applications may provide continuity of education in programs such as obesity prevention despite the many relocations children of military personnel may experience.

Reportable Outcomes:

No abstracts have been submitted for presentation or publication at this time.

Conclusions:

Healthy People 2010 identified important priorities addressing the health and wellness of children and adolescents. Although objective 19-3, "reduce the proportion of children and adolescents who are overweight or obese", has received much attention, school and health professionals must also focus on preventing the weight gain by promoting health lifestyles. *Healthy People* objective seven focuses on schools providing school health education in priority areas, identifying unhealthy dietary patterns and inadequate physical activity as two of these priorities.

To address the issue of childhood obesity, the Federal Government passed the Child Nutrition and WIC Reauthorization Act in June 2004. This act required all Local Education Agencies that participate in National School Lunch or Breakfast Program(s) to execute a Wellness Policy. This policy must include goals for physical activity, nutrition education, and other interventions that promote students wellness. In response to the obesity epidemic, Pennsylvania legislature passed Act 114 of 2006 that revised several sections of the school code to address childhood obesity and the federal wellness policy. Subsequently, every Pennsylvania school district must incorporate their Wellness Policy into the district's five year strategic plan to assure compliance and execution of the Wellness Policy.

Administration personnel for both partnering school districts are investigating the integration of this wellness curriculum into their local Wellness Policies. Because the lesson plans address Pennsylvania Academic Standards for Health, Safety, and Physical Education, the curriculum could be executed as part of the existing health education programs. The school administrators are particularly interested in this curriculum because the course content provides information for adolescents to make educated choices regarding their eating and activity habits.

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Appendices:

Recruiting letters and surveys are attached.

Modifiable Activity Questionnaire for Adolescents

DATE ______________ Participant Number ________________________________

SCHOOL ______________________

1. How many times in the past 14 days have you done at least 20 minutes of exercise hard enough to make you breathe heavily and make your heart beat fast? (Hard exercise includes, for example, playing basketball, jogging, or fast bicycling; include time in physical education class)

   ( ) None
   ( ) 1 to 2 days
   ( ) 3 to 5 days
   ( ) 6 to 8 days
   ( ) 9 or more days

2. How many times in the past 14 days have you done at least 20 minutes of light exercise that was not enough to make you breathe heavily and make your heart beat fast? (Light exercise includes playing basketball, walking or slow bicycling; include time in physical education class)

   ( ) None
   ( ) 1 to 2 days
   ( ) 3 to 5 days
   ( ) 6 to 8 days
   ( ) 9 or more days

3. During a normal week how many hours a day do you watch television and videos, or play computer or video games before or after school?

   ( ) None
   ( ) 1 hour or less
   ( ) 2 to 3 hours
   ( ) 4 to 5 hours
   ( ) 6 or more hours

4. During the past month, how many team or individual sports or activities did you participate in on a competitive level, such as varsity or junior varsity sports, intramurals, or out-or-school programs?

   ( ) None
   ( ) 1 activity
   ( ) 2 activities
   ( ) 3 activities
   ( ) 4 or more activities

   What activities did you compete in?

   ____

   ____

   ____

   ____

   ____

   ____

PAST YEAR LEISURE-TIME PHYSICAL ACTIVITY

Check all activities that you did at least 10 times in the **PAST YEAR**. Do not include time spent in school physical education classes. Make sure you include all sport teams that you participated in during the last year.

1. Aerobics
2. Band/Drill Team
3. Baseball
4. Basketball
5. Bicycling
6. Bowling
7. Cheerleading
8. Dance Class
9. Football
10. Garden/Yard Word
11. Gymnastics
12. Hiking
13. Ice Skating
14. Roller Skating
15. Running for Exercise
16. Skateboarding
17. Snow Skiing
18. Soccer
19. Softball
20. Street Hockey
21. Swimming
22. Tennis
23. Volleyball
24. Water Skiing
25. Weight Training (Competitive)
26. Wrestling
27. Others:

____

____

____

Record any of the activities that you listed above that you did in the past month from month, xx, 2007 to month, xx, 2007. Do not include time spent in school physical education classes. Make sure you include all sport teams that you participated in the last month.

Activity	Number of Times per Month	Minutes per Time

SAINT FRANCIS UNIVERSITY
FOUNDED 1847

Month, Day, 2007

To: Parents of eighth grade students
Penn Cambria School District

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA), is investigating the benefits of utilizing telehealth in the prevention of obesity for rural Western Pennsylvania ninth grade students. All students entering ninth grade will be asked to join the study. Taking part in this research is entirely voluntary. Your child does not have to participate in this study. You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

The study will give CERMUSA insight into supplementing existing school health services to prevent obesity. Telehealth applications such as video tele-conferencing (VTC) and interactive Internet sites will supplement school nursing services to provide education on nutrition and activity to an intervention group, ninth grade students in the Cambria Heights School District. Your child will not receive this education. The researchers will compare results between the two school districts to evaluate if the wellness education made an impact in the prevention of obesity and the health of the students. The results of this study will be in a report to the funding agency, Telemedicine and Advanced Technology Research Center (TATRC) section of the Department of Defense U.S. Army Medical Research and Materiel Command (USAMRMC). The results of the study may also be published in relevant journals and presented at selected conferences so that others wishing to provide this education may do so.

Your child's participation in this research will involve him/her providing information on height and weight, absentee rates, and number of visits to the school health office during his/her ninth grade academic year (ten months). Your child will be asked his/her gender and race, since the study is aimed at finding trends in telehealth education and obesity. Your child will also be asked your zip code to determine your geographic locations, since the study is aimed at telehealth education in rural and remote areas.

All students in the study will be asked to complete an activity questionnaire at the beginning and end of the school year to determine the usefulness of the telehealth education. Students at Cambria Heights High School will also take the activity questionnaire before and after the nutrition and activity education for a total of three or four times. The number of times they take the questionnaire depends on which marking period they take the class.

We will protect your child's privacy as much as possible. Your child's name will never be used in any article or report. The researchers will keep the surveys and consent forms in a locked file at CERMUSA for seven years. The surveys will not have any of your child's identifying information on them, only a participant number. Other than the number of height/weight measurements, school health visits and absenteeism, CERMUSA researchers will not have access to your child's school health records.

CERMUSA
Center of Excellence for Remote and Medically Under-Served Areas
P. O. Box 600, Loretto, PA 15940 Phone: (814) 472-3389 Fax: (814) 472-3377
www.cermusa.francis.edu

There are no identified risks identified with this study. If you choose not to permit your child to act as a subject in this study, your child will still receive the health and nutrition education as outlined by your school's policies.

You and your child may develop a better understanding of weight, nutrition, and obesity. The results of this research will be available to you once the technical report is completed. The results of this research may be used to develop a curriculum for your school and other school districts.

If you have any questions or concerns, please contact me at (814) 472-3249 or cwendekier@cermusa.francis.edu. Thank you for your time.

Sincerely,

Camille Wendekier, CRRN, MSN
Telehealth Development Specialist

Month, Day, 2007

To: Parents of eighth grade students
Cambria Heights School District

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA), is investigating the benefits of utilizing telehealth in the prevention of obesity for rural Western Pennsylvania ninth grade students. All students entering ninth grade will be asked to join the study. Taking part in this research is entirely voluntary. Your child does not have to participate in this study. You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

The study will give CERMUSA insight into supplementing existing school health services to prevent obesity. Telehealth applications such as video tele-conferencing (VTC) and interactive Internet sites will supplement school nursing services to provide education on nutrition and activity to ninth grade students in the Cambria Heights School District. Ninth grade students at Penn Cambria School District will not receive this education. The researchers will compare results between the two school districts to evaluate if the wellness education made an impact in the prevention of obesity and the health of the students. The results of this study will be in a report to the funding agency, Telemedicine and Advanced Technology Research Center (TATRC) section of the Department of Defense U.S. Army Medical Research and Materiel Command (USAMRMC). The results of the study may also be published in relevant journals and presented at selected conferences so that others wishing to provide this education may do so.

Your child's participation in this research will involve him/her providing information on height and weight, absentee rates, and number of visits to the school health office during his/her ninth grade academic year (ten months). Your child will be asked his/her gender and race, since the study is aimed at finding trends in telehealth education and obesity. Your child will also be asked your zip code to determine your geographic locations, since the study is aimed at telehealth education in rural and remote areas. Students at Cambria Heights High School will receive the nutrition and activity education, acting as the interventional group. Ninth grade students in Penn Cambria High School will not receive this education, acting as control subjects.

All students in the study will be asked to complete an activity questionnaire at the beginning and end of the school year to determine the usefulness of the telehealth education. Students at Cambria Heights High School will also take the activity questionnaire before and after the nutrition and activity education for a total of three or four times. The number of times they take the questionnaire depends on which marking period they take the class.

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The nutrition and activity education will be delivered to your child in the usual classroom setting. Guest speakers will be integrated into the education periodically through VTC. Virtual Classroom Software (VCS), WebCT, will be used to provide a supplement to the classroom education. WebCT will provide your child additional learning activities and pre/post tests through a website on the Internet. This website will be hosted and maintained by CERMUSA.

The surveys, quizzes, and the learning activities on the Internet are directly related to the objectives and content of the classroom material. A course syllabus will outline the use of the surveys, quizzes, and learning activities. The tests will be able to measure what your child has learned after participating in the course and Internet learning activities. The survey will reflect your child's impressions and suggestions regarding the course content. Your child will have the opportunity to complete each quiz indefinitely and may complete the pre-test, post-test, and survey once during the wellness classes. The survey is free of unnecessary demographic identifiers.

We will protect your child's privacy as much as possible. Your child's name will never be used in any article or report. The researchers will keep the surveys and consent forms in a locked file at CERMUSA for seven years. The surveys will not have any of your child's identifying information on them, only your participant number. Other than the number of BMI measurements, school health visits and absenteeism, CERMUSA researchers will not have access to your child's school health records.

There are no identified risks identified with this study. If you choose not to permit your child to act as a subject in this study, your child will still receive the health and nutrition education as outlined by your school's policies. If your child does not participate in this research, he/she will still receive the nutrition and activity education as described in this letter, but the researchers will not collect any data on these students.

You and your child may develop a better understanding of weight, nutrition, and obesity. The results of this research will be available to you once the technical report is completed. The results of this research may be used to develop a curriculum for your school and other school districts.

If you have any questions or concerns, please contact me at (814) 472-3249 or cwendekier@cermusa.francis.edu. Thank you for your time.

Sincerely,

Camille Wendekier, CRRN, MSN
Telehealth Development Specialist

AFFECTIVE SURVEY

1. I am a

   a. Female
   b. Male

Answer: _____

2. I am _____ years old.

   a. 14
   b. 15
   c. 16

Answer: _____

3. Young people should be physically active for at least ____ minutes each day. (check only one option)

   a. 15
   b. 30
   c. 45
   d. 60

Answer: _____

4. Check all the actions that you think are physical activities:

   a. Walking
   b. Carrying groceries
   c. Climbing stairs
   d. Playing soccer
   e. Doing housework (dusting, vacumming)

Answer: _____

5. Physical activity is anything that gets your body moving.

   a) Yes
   b) No

Answer: _____

6. I am currently physically active for at least ____ minutes each day.

   a. 20
   b. 30
   c. 40
   d. 60
   e. more then 60
   f. less then 15

Answer: _____

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7. I intend to be physically active for at least an hour a day during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

8. I intend to do more weight-bearing activities during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

9. I eat at least ____ servings of fruits or vegetables daily.

a. 3
b. 5
c. 7
d. more then 7
e. less then 3

Answer: _____

10. I intend to eat more fruit and vegetables during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

11. I eat _________ high-fat snack foods each day.

a. 1 - 3
b. 4 - 6
c. 7- 9
d. 10 - 12
e. more then 12

Answer: _____

12. I intend to eat fewer high-fat snack foods during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

13. I intend to eat more whole-grain foods during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

14. I intend to eat or drink more foods with calcium during the next month.

a. Strongly Agree
b. Somewhat Agree
c. Neither Agree or Disagree
d. Somewhat Disagree
e. Strongly Disagree

Answer: _____

15. I would rate my current activity level as ____________

a. Poor - I get very little or no physical exercise
b. Average - I get some physical exercise
c. Outstanding - I get a lot of exercise each day

Answer: _____

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Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Management and Prevention of Chronic Diseases through Telehealth

Protocol No.: 06-TATTH224-06

Date: March 12, 2008

Protocol Title: Management and Prevention of Chronic Diseases through Telehealth

Principal Investigator: Camille Wendekier, CRRN, MSN

Protocol Executive Summary:

In 2001, chronic conditions accounted for nearly $1.06 trillion in healthcare costs and is expected to reach $2.5 trillion in the year 2012 (Todd, 2003). Obesity, diabetes, and their secondary conditions contribute significantly to these healthcare expenditures. Disease management strategies can play an integrative role in the use of healthcare resources by people with these conditions. The Chronic Care Model identifies the community, the health system, self-management support, delivery system design, decision support, and clinical information systems as essential constructs in chronic disease management (Wagner, 1998). Using the chronic care model as a foundation, telehealth applications can play a vital role in improving/supporting disease management systems.

The expanded use of a chronic disease registry for patients with and without diagnosed chronic diseases is being used to retrospectively investigate data to identify people at risk for developing these conditions prior to the development of overt risk factors such as obesity and hypertension. The ability to impede the development of chronic disease such as diabetes and cardiovascular disease may not only improve morbidity and mortality rates, but may also improve the quality of life for millions of people. The expanded use of the software is also being employed to evaluate impact of telehealth applications in long term clinical outcomes.

This research protocol utilized the Patient Electronic Care System (PECSYS) to collect clinical data on adult patients of the Primary Care Center of Mt. Morris. A diagnosis of a chronic disease was not a requirement for participation in the study. Healthcare providers at the clinic uploaded clinical data in PECSYS to evaluate the ability of the software to manage care such as preventive screenings and diagnostic testing. Researchers have the option of following study participants for up to seven years. Participants diagnosed with diabetes who have previously used Acculink modems for submission of their glucose logs had the option to continue using the modems. Comparisons will be made between the participants who use the modems to those diagnosed with diabetes who do not use the modems.

Introduction:

Chronic disease is widely recognized as the main contributor to morbidity, mortality, and health-related costs in the United States (Anderson & Horvath, 2002). It is estimated that chronic conditions cause a loss of 164 million workdays in the United States, costing employers $30 billion (Annoymous, 2007). There are currently over 100 million people in the U.S. affected by one or more chronic diseases such as diabetes, hypertension, and asthma (Todd, 2003). Obesity, another chronic condition, globally affects over 1.6 billion adults, 400 million of whom are clinically obese (World Health Organization [WHO], 2006). WHO further projected that over 2.3 billion people will be overweight (a basal metabolic index [BMI] 25 or greater) and over 700 million people will be obese (a BMI of 30 or greater) by 2015 (WHO, 2006).

As the prevalence of obesity has increased, so too has the incidence of obesity-related diseases, including Type 2 diabetes, cardiovascular disease, and several types of cancer (Finkelstein, Ruhm, & Kosa, 2005). Costs to treat these chronic diseases are likely to reach $2.5 trillion by the year 2012 (Coile, 2003). These chronic diseases impact the utilization of medical resources, healthcare costs, and ultimately the patients' quality of life.

In 2001, spending on healthcare in the United States was $1.42 trillion, which is slightly more than the 14% gross domestic product (Todd, 2003). Chronic conditions accounted for nearly three-quarters of these expenditures (Todd, 2003). Diabetes, obesity, and their secondary conditions contributed significantly to these healthcare expenditures.

Obesity

Obesity, a growing epidemic in the United States, accounts for annual estimated direct and indirect healthcare costs of more than $117 billion to treat this condition (Carmona, 2005). Obesity also contributes to approximately 400,000 deaths per year, second only to tobacco (Mokdad, Stroup, Gerbeding, 2000). It is estimated that 66.3% of United States adults have a BMI greater than 25, with 32% of this adult population being obese (Centers for Disease Control and Prevention [CDC], 2007).

Obesity is affecting people of all ages, races, ethnicities, and social classes. Many military families are affected by obesity and the secondary conditions associated with it. Because of the incidence of obesity, the U.S. Preventative Services Task Force expressed the need for clinicians to screen all adult patients for obesity and offer intensive counseling and behavioral intervention to promote successful weight loss (U.S. Preventative Services Task Force, 2003). Raising awareness through the promotion of healthy dietary choices is the first step in combating obesity. Too many Americans lack the educational foundation to grasp food concepts in maintaining a healthy weight (Carmona, 2005). Health literacy is vital to understanding fundamental information such as over the counter medication directions and to performing crucial health maintenance tasks such as eating a balanced diet and receiving recommended medical care.

Low health literacy adds as much as $58 billion per year to annual healthcare costs (Carmona, 2005). Each year, seven out of ten deaths related to a chronic disease could be prevented or delayed by eating well, being physically active, and/or not smoking (Carmona, 2005).

To aid with health literacy, the United States Department of Agriculture (USDA) combined with the United States Department of Health and Human Services (USDHHS) to publish *Dietary Guidelines for Americans* (Nappo-Dattoma, 2005). The creation of these guidelines serves to facilitate healthy dietary planning and reduce chronic diseases among the American Population through proper nutrition (Nappo-Dattoma, 2005). In 1991, the food guide pyramid was created for this document, providing fundamental principals for a healthy diet (Nappo-Dattoma, 2005). Although health education resources like the food guide pyramid are readily available via the Internet, many people do not utilize them either due to ignorance or lack of resources to access the Internet.

Diabetes
As diabetes, morbidity, and mortality rates are escalating, so are the economic and social ramifications of this serious disease. In 2005, the Center for Disease Control estimated that 7% of the population is affected by diabetes, an increase from 18.2 in 2003 to 20.8 million Americans (American Diabetes Association [ADA], 2005b). While Pennsylvania hospital charges have risen 19% from 2002 to 2004, for a total of $673,663,573, the most recent cost estimates are from 2002 where indirect and direct diabetes expenses were estimated to be $132 billion (Pennsylvania Health Care cost Containment Council, 2005; ADA, 2005a). The rise in the prevalence of diabetes causes grave concerns not only due to the economic ramifications of the disease, but also due to the social consequences of this chronic illness. Lost work/school days, premature retirement, disability, decreased quality of life, and increasing death rates are only a few examples. Many of these adverse situations are due to the debilitating secondary conditions associated with diabetes. With one in five Americans being at risk for developing diabetes, many federal and national organizations are promoting efforts to educate the public on preventing the development of the disease and/or its secondary conditions (ADA, 2005a). One instrumental intervention in the prevention of Type 2 diabetes, which accounts for 90-95% of all diagnosed cases of diabetes, is the deterrence of obesity (ADA, 2005a).

Utilization of Disease Management Strategies
Disease management is defined as a system of coordinated healthcare interventions and communications for patients with chronic conditions in which patients themselves can play an integrative role in the control of their health and medical services (Todd, 2003). Disease management programs emphasize the prevention of secondary complications by ensuring that clinicians use evidence-based guidelines for the provision of primary and secondary care while promoting the health literacy of their patient population. Subsequently, the patients are empowered to effectively manage their symptoms, medications, and healthcare resources.

Key functions of disease management include: population identification processes; evidence-based practice guidelines; collaborative practice models to include physician and support-service providers; patient self-management education (including primary prevention, behavior modification programs, and compliance/surveillance); measurement of processes and outcomes; and routine reporting (Disease Management Association of America, 2006).

Obesity
Treatment of overweight and obese patients requires a comprehensive approach involving diet and nutrition, regular physical activity, and behavioral change, with an emphasis on long-term weight management (Lyznicki, Young, Riggs, & Davis, 2001). Health professionals have an important role in promoting preventive measures and positive lifestyle behaviors in the prevention of obesity. Healthcare professionals are vital components in safe weight loss and weight management programs and are fundamental in identifying and treating obesity-related conditions (Lyznicki, Young, Riggs, & Davis, 2001). Although the majority of clinicians are aware of the grave importance in the treatment and prevention of obesity, they are often unable to focus on appropriate interventions to accomplish these tasks. Increased acuity of patients, increased administrative duties, and increased patient load are examples of obstacles clinicians face when attempting to administer proactive care.

Diabetes

Disease management goals for diabetes are to reduce glucose levels and prevent complications. Careful control of blood glucose levels can reduce the risk of complications from diabetes. Education and disease management programs have been successful in helping to decrease some costs associated with diabetes. Successful management of diabetes requires lifestyle changes for the patient, including diet and exercise and self-monitoring of blood glucose levels. Patients must be involved in the decision-making process and learn as much as possible about diabetes. Deficiencies in the healthcare system prevent patients with diabetes from receiving preventative screenings, education, and proactive treatments. These deficiencies, which often hinder the healthcare team's ability to follow established treatment guidelines, include lack of care coordination, lack of follow-up care, time constraints faced by many practitioners, and patients inadequately trained to manage their chronic disease (Wagner, 1998). A comprehensive approach to diabetes management can assist clinicians to diminish these deficiencies and improve delivery of care.

The Chronic Care Model

The Chronic Care Model, developed by Richard Wagner (1998), identifies the community, the health system, self-management support, delivery system design, decision support, and clinical information systems as the essential constructs in chronic disease management. Efficient chronic disease management systems must assure behaviorally sophisticated self-management support; reorganize team function and practice systems to meet the needs of the patient population; adhere to evidence-based guidelines through provider education, reminders, and coordinated interaction between generalists and specialists; and enhance information systems (Wagner, 1998).

With each of the chronic conditions mentioned above, self-management skills are vital in preventing exacerbations. For example, proper nutrition skills have a large impact on blood glucose levels for people with diabetes and play a crucial role in the prevention of obesity. The daily decisions patients with chronic conditions make may impact their health status more than those decisions made in conjunction with their healthcare providers.

Enhanced information systems are valuable assets that enable healthcare systems to adequately organize the delivery of care, implement evidenced-based guidelines, and gather clinical data. Through the use of software applications such as disease registries, clinicians can utilize tools such as reminders to coordinate proactive care between primary care facilities and specialists. This can be seen in diabetes management where the endocrinologist or primary care clinician coordinates the recommended screenings from specialists such as ophthalmologists and podiatrists for his/her patient population. The registry's basic function is to act as a support mechanism for the delivery of chronic care by applying patient-specific information at the point of care, identifying patients with gaps of care, identify patients who require follow-up care, and provide status reports that act as feedback to physicians regarding their performance and to track programs with population management (Metzger, 2004).

Telehealth technology can vastly supplement the delivery of comprehensive chronic disease care as seen in the following examples.

- The use of a chronic disease registry will provide the infrastructure to evaluate the long term effects of telehealth applications as well as to provide the resources to retrospectively study trends in the development of chronic disease before the presence of overt symptoms.
- CERMUSA's past research has successfully demonstrated the ability to import blood glucose logs from an analogue modem into a secure database. This technology reduced the isolation of homebound patients from their healthcare providers. The ability to import data from devices such as glucose meters not only will enhance the utility of the chronic disease registry, but also will enable the healthcare providers to effectively deliver evidenced-based care.

***Hypothesis*:**
A chronic disease registry, a clinically related information system, is designed to improve chronic illness care and act as a quality improvement tool for healthcare providers. The use of a chronic disease registry will allow clinicians to prevent secondary co-morbidities associated with conditions such as diabetes, heart disease, and obesity by:

- Centralizing patient information
- Evaluating disease management
- Measure patient outcomes

This research protocol will optimize the implementation of a chronic disease registry to:

- Compare disease management augmented with telehealth to that of usual care
- Act as a prognostic tool for chronic diseases

The study will also trend for age, gender, race, education level, income, and presence of health insurance coverage to explore if any population in the study are statistically significant. The data will be analyzed for trends indicating if particular subpopulations have an increased prevalence of diagnosed chronic disease, differences in disease management outcomes, and differences in disease risk factors for patients without a diagnosis of a chronic disease. Furthermore, the data will be followed on a long term basis to mine for trends in disease development prior to the presence of overt signs, symptoms, and risk factors.

Objective of Research Protocol:
Objectives:

- Explore trends in data to identify risk factors of developing chronic diseases prior to the development of evident risk factors such as obesity, hypertension, and hyperlipidemia.
- Adhere to recommended guidelines in recommended preventive screenings such as colon, breast, and prostate cancer screenings.
- Adhere to recommended guidelines in rates of diagnostic tests used in primary and secondary preventative care. Examples include HbA1c, LDL, and Cholesterol.
- Improve the absolute values of diagnostic tests such as HbA1c, LDL, and Cholesterol.
- Adhere to recommended guidelines for secondary preventive screenings, such as eye and foot.
- Improve the absolute values of diagnostic measures such as blood pressure and weight.

- Diminish diabetes related distress as indicated by change in The Problem Areas in Diabetes Scale (PAID) for patients utilizing Acculink Modems. This survey is located in Appendix B.
- Improve perception of quality of life (QOL) as indicated by change in the Center for Disease Control and Prevention's Health Related Quality of Life Measure (HRQOL-14) for participants utilizing Acculink Modems.

Technical Objectives:
- Explore the potential for an interface that would permit the chronic disease registry to integrate data with electronic medical records utilized by the rural clinic.
- Explore the potential of importing data from additional telehealth applications into the registry database.

Methods:

CERMUSA partnered with the Primary Care Center (PCC), located in Mt. Morris, Pennsylvania, to implement this research protocol. PCC provides services to over 4,000 patients in rural Southwestern Pennsylvania. PCC staff was trained in the use of chronic disease registry software, the Patient Electronic Care System (PECSYS), by the Aristos Group. Due to many concurrent demands, PCC staff were not able begin execution of the study until July 2007.

This research protocol intends to compare outcome markers such as HbA1c, LDL, and Cholesterol from study participants diagnosed with diabetes who utilize the chronic disease registry at the Primary Care Center of Mt. Morris. Diagnostic, screening, and intervention data gathered on participants without the diagnosis of diabetes will be investigated to identify trends or risk factors of developing diabetes prior to the development of any overt risk factors or symptoms. Initially, baseline information such as BMI, waist circumference, reported activity level, reported diet, laboratory tests, and preventive screenings will be collected from the participants' registry records. Laboratory tests will include biomarkers for cardiometabolic risk assessment such as fasting blood sugar, glucose tolerance tests, HbA1C, lipid panel, urine albumin, fibrinogen, complete blood count, C Reactive Protein, and uric acid. This data in conjunction with quality of life data, described below, will be collected on a matched timeframe from initial entry to latest entry before any comparisons are performed.

CERMUSA researchers developed the capability of importing blood glucose logs into PECSYS. Clinicians at Mt. Morris recruited 19 study participants to utilize the Acculink modems to import blood glucose logs into PECSYS. These participants using the modems continued to document their blood glucose levels at home as directed by their healthcare providers at PCC. All study participants with a diagnosis of diabetes completed a diabetes specific quality of life survey, Problem Areas In Diabetes (PAID), on study entrance and exit. The results of the PAID will be compared between participants who are using the Acculink Modem and those who are not. Also, every participant in the study will complete a generic health related quality of life survey every six months, HRQOL-14. The results of this survey will be compared between and within diagnostic groups. No identifying information was recorded on the questionnaires. Participants were not required to answer all questions on the questionnaires; they had the option to refuse to answer any or all questions on these surveys.

Clinicians at the Primary Care Center of Mt. Morris informed their patients that patient education is available on a web site hosted by CERMUSA, and that the researchers will be tracking the number of people using it. It was up to their discretion if they choose to access this website, My Health & Education Resources Online (My HERO). Those patients who do not have Internet access at home accessed this information at public Internet access points such as public libraries or the patient education kiosk deployed by CERMUSA, located in the waiting room of PCC.

Use of the Internet for patient education entailed a descriptive study. This website will contain links to resources such as the American Diabetes Association, American Heart Association, NIH Senior Health.gov, Pennsylvania Department of Health, Accessible PA, Commonwealth of Pennsylvania Access to Social Services (COMPASS), and McKesson Software, Adult Health Advisor. This website will be available to the general population. It was intended to provide the option of taking pre and post tests for the diabetes education modules in the McKesson Adult Health Manager.

When incorporating the Internet adult education module into My HERO, CERMUSA technicians encountered an unexpected problem. While installing the software on the server for the test site, which is not accessible to the public, CERMUSA technicians discovered that the software contained hundreds of HyperText Markup Language (HTML) files. The numerous files presented many problems. First, these files would use a large amount of space on the server. Customization of the files would entail many hours. Without customization, the program would appear disheveled and may confuse the user. Also, due to the hundreds of files, it was not feasible to create a search engine for the software content. The optimum solution in addressing these issues is to create a database to implement this software. Being database driven, the program would be easier to maintain, data updates would be more timely and efficient, and the program would take up less room on the server hosting My HERO. CERMUSA technicians are now developing the database for this program.

CERMUSA researchers have developed the capability to conduct pre- and post-testing for the diabetes content in Adult Health Advisor, but are unable to conduct testing until the program is database driven. As previously stated, the hundreds of files in the McKesson software hindered the ability to implement online testing. CERMUSA researchers plan to test the capability to administer pre- and post-tests for the diabetes education module in this software once the database is complete.

PCC staff was responsible for recruiting a convenience sample using the following criteria.

Inclusion criteria:

- Participants must be 18 years of age or older
- Participants will possess full capacity to give informed consent. This entails:
    - Participants must be alert and oriented to person, place, and time
    - Participants must be capable of signing for consent of treatment at the Primary Care Center of Mt. Morris
    - Reported total blindness must possess a signature guide

    - Reported hearing loss must either be compensated by hearing aid, telecommunications device for the deaf (TDD), or ability to read lips
- Participants must be clients of the Primary Care Center of Mt. Morris
- Participants utilizing Acculink modems must meet the following criteria:
    - Be diagnosed with Type 1 or Type 2 diabetes
    - Use Roche Diagnostic's Accu-Chek Advantage Glucose Meter
    - Participant's residence must have an active analog telephone line.

Target population was any patient of the Primary Care Center of Mount Morris who is a minimum of 18 years of age. Participants medical histories varied because the presence of any one diagnosis was not used as a criteria for subject recruitment. No minority or subgroups were excluded from the research project.

Justification for exclusion from the study:

- Not a client of the Primary Care Center of Mt. Morris
- Patients of the Primary Care Center of Mt. Morris under the age of eighteen
- Pregnancy

The study aimed to recruit a convenience sample of 300, 30 of which would use the Acculink modems. PCC staff informed potential participants of the research project. The researchers would then answer any questions these people had regarding the study. After addressing their questions/concerns, the researchers obtained informed consent from the patients. To date, PCC staff was only able to recruit 48 participants after interviewing over 400 patients.

The original signed informed consents were initially stored in locked files at the Primary Care Center of Mt. Morris. The principle investigator collected the original consents and relocated the documents to locked files at CERMUSA where they will be stored. A copy of the signed consent was given to the participants. A copy of the informed consent will also be stored in locked files at the Primary Care Center of Mt. Morris.

To qualify for participation in this study, participants consented to the use of all de-identified data collected to be used for research and reporting processes. All data collected from participants are stored in a locked file at CERMUSA in compliance with the Health Insurance Portability and Accountability Act (HIPAA) of 1996 regulations.

All data submitted to CERMUSA from registry records was de-identified to maintain participant anonymity. Participants utilizing the Acculink modems to transport glucose logs into the database used the serial number of their Accuchek Advantage glucose meter to identify the data during and after transport. Once the data from the glucose meters uploaded into PECSYS, the serial number of the meter linked the information to the patient's records. No identifying information will be associated with the glucose logs during the analog transmission or during data analysis.

Protocol Data Collection:
CERMUSA researchers supported the chronic disease registry on a server housed at CERMUSA. Because the clinic utilizes electronic medical records (EMR), CERMUSA researchers explored the possibility of developing an interface between the registry software and EMR software. After reviewing the platforms and programming language for each the registry and EMR, CERMUSA technicians derived that interoperability of the two software programs would only be possible with the assistance of the software developers, the Aristos Group and Misys Healthcare Systems. Representatives from these companies quoted a minimum combined cost of $60,000 to develop an interface for the registry and EMR.

Once enrolled in the study, participants will be followed in the chronic disease registry while receiving medical management according to evidenced based practice guidelines. All laboratory and diagnostic testing were performed within the standards of medical care. Collection of the following data is scheduled to occur on entrance into the study and every six months thereafter.

- Data such as demographics, BMI, waist circumference, reported activity, reported diet, office visit information, and laboratory test information (including but not limited to fasting blood sugar, glucose tolerance tests, HbA1C, lipid panel, urine albumin, fibrinogen, complete blood count, C Reactive Protein, and uric acid). A complete list of this data can be viewed on the example reports in the Diabetes and Cardiovascular Registry Summary reports.

The longitudinal affects of current and future telehealth interventions will be assessed from the data collected via the registry. The researchers will then investigate for trends and themes among the participant population using or who have used telehealth that otherwise would not be salient.

Upon study execution, it was intended that the Primary Care Center of Mt. Morris and CERMUSA researchers will establish a set of queries to determine routine care needs for the study population. Because PCC's EMR and PECSYS are not interoperable, the clinic staff had to perform duplicate entry of participant data. The increased work load of duplicate entry coupled with the existing demands of this rural clinic prohibited the staff to utilize PECSYS queries in patient care. As participant recruitment continues, CERMUSA researchers will receive hard copies of the de-identified reports generated by the registry as well as electronic data in the form of Microsoft Office Excel documents for further statistical analysis.

Results and Analysis:

Due to delayed study execution, and multiple concurrent demands of PCC staff, only 19 of the participants completed surveys when entering the study. Because the remainder of the participants have recently signed the consents, the PI has not had an opportunity to collect quality of life data.

The many concurrent demands on PCC staff prohibited them to recruit the proposed 300 participants. This coupled with the lack of data resulted in CERMUSA terminating the research protocol.

CERMUSA's education web site, My Health & Education Resources Online (My HERO) has been running throughout the study. To date, there have been a total of 12,856 hits with an average of 35 hits per day. Once the site is database driven, data will be further analyzed as previously discussed in the methodology.

Key Research Accomplishments:

Although the study protocol was terminated, CERMUSA and PCC will continue to conduct a needs analysis to develop future research endeavors. These upcoming projects will be designed so that the objectives and executable tasks are viable for both CERMUSA researchers and the clinic staff.

Future endeavors between CERMUSA and PCC will continue to address the prevalence of chronic diseases. The ability of enhance prevention and management of chronic diseases will save the Department of Defense, public insurers, and private health insurance companies many resources.

Reportable Outcomes:

No abstracts have been submitted for presentation or publication at this time.

Conclusions:

The partnership between CERMUSA and PCC began after a needs assessment divulged the constraints of accessing healthcare in Greene County Pennsylvania as evidenced by the following information.

- 24.3% of the population having an education of less than a high school diploma (U.S. Census Bureau, 2000);
- 14.6% of the population lives below poverty level (Pennsylvania Department of Health, 2007);
- 22.5% of the population is eligible for Medical Assistance (Pennsylvania Department of Health, 2007);
- Diseases of the Heart is the leading cause of death (Pennsylvania Department of Health, 2007);
- Diabetes is the 6th leading cause of death (Pennsylvania Department of Health, 2007);
- Low income Appalachian whites have a shorter life expectancy than Northland low-income rural whites and Middle America (Murray, Kulkarni, & Ezzati, 2005);
- Population density of approximately 69 people per square mile;
- One acute care hospital located within Greene County (Pennsylvania Department of Health, 2007).

Both institutions agreed that executing telehealth research in the county may not only improve access to healthcare and education, but may also yield valuable insights on epidemiological data specific to rural Appalachia. This is significant since many young Appalachian residents enlist in the armed services because of decreased opportunities for employment and/or education.

Study execution and participant recruitment were severely constrained due to several issues. This rural primary care clinic has a very high patient census, limited resources, and staffing issues that mandate prioritization of work tasks. Provision of patient care is the foremost priority for the clinic and its staff. Due to the nature of the clinic, approximately half of the patients seen per day are unscheduled, and are seen due to emergencies or severe illness. Repeatedly, the clinicians have worked in excess of eight hours and were unable to execute additional tasks, such as duplicate entries into PECSYS, once they completed patient care.

Thus far, approximately 400 patients were invited to join the study. The majority of PCC patients invited to join the study declined discuss the study, with very few of these patients willing to review the informed consent. When asked why they declined to participate in the study, participants generally responded that it was due to a lack of interest in the study or distrust in sharing medical information with an outside agency (CERMUSA). Historically, Appalachian culture has demonstrated these people are very independent and have a deep mistrust in new situations and new people. This coupled with lower education and income levels may have caused the patients' apathy toward the research.

CERMUSA researchers, available to clinic staff 24 hours per day, have provided a multitude of technical support to clinic staff. Despite this support, study execution has been severely impaired due to the aforementioned issues. The only additional support CERMUSA could provide is for a researcher to travel to the clinic for participant recruitment and entry of data into PECSYS. In that the clinic is located 150 miles from Saint Francis University, this is not a feasible or sustainable solution. Although the clinic is in favor of conducting the research and want to continue in the study, limited resources and time constrictions prohibit efficient execution of the project.

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Appendices:

Please refer to attachments for Quality of Life Questionnaires.

Problem Areas In Diabetes (PAID) Questionnaire

INSTRUCTIONS: Which of the following diabetes issues are currently a problem for you?

Circle the number that gives the best answer for you. Please provide an answer for each question.

	Not a problem	Minor problem	Moderate problem	Somewhat serious problem	Serious problem
1. Not having clear and concrete goals for your diabetes care?	0	1	2	3	4
2. Feeling discouraged with your diabetes treatment plan?	0	1	2	3	4
3. Feeling scared when you think about living with diabetes?	0	1	2	3	4
4. Uncomfortable social situations related to your diabetes care (e.g., people telling you what to eat)?	0	1	2	3	4
5. Feelings of deprivation regarding food and meals?	0	1	2	3	4
6. Feeling depressed when you think about living with diabetes?	0	1	2	3	4
7. Not knowing if your mood or feelings are related to your diabetes?	0	1	2	3	4
8. Feeling overwhelmed by your diabetes?	0	1	2	3	4
9. Worrying about low blood sugar reactions?	0	1	2	3	4
10. Feeling angry when you think about living with diabetes?	0	1	2	3	4
11. Feeling constantly concerned about food and eating?	0	1	2	3	4
12. Worrying about the future and the possibility of serious complications?	0	1	2	3	4
13. Feelings of guilt or anxiety when you get off track with your diabetes management?	0	1	2	3	4
14. Not "accepting" your diabetes?	0	1	2	3	4
15. Feeling unsatisfied with your diabetes physician?	0	1	2	3	4
16. Feeling that diabetes is taking up too much of your mental and physical energy every day?	0	1	2	3	4
17. Feeling alone with your diabetes?	0	1	2	3	4
18. Feeling that your friends and family are not supportive of your diabetes management efforts?	0	1	2	3	4
19. Coping with complications of diabetes?	0	1	2	3	4
20. Feeling "burned out" by the constant effort needed to manage diabetes?	0	1	2	3	4

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HEALTH-RELATED QUALITY-OF-LIFE MEASURE (HRQOL-14)

Health Care and Aging Studies Branch
Division of Adult and Community Health
National Center for Chronic Disease Prevention and Health Promotion
Centers for Disease Control and Prevention

The 4-item set of health-related quality-of-life questions (HRQOL-4) below has been in continuous use in the state-based Behavioral Risk Factor Surveillance System (BRFSS) since January, 1993 (See http://www.cdc.gov/nccdphp/brfss/). As of the end of 1999, over 800,000 adults aged 18 and older have responded to these core BRFSS questions. Beginning in 2000, the HRQOL-4 are also asked in the National Health and Examination Survey (NHANES) for persons aged 12 and older. A related 10-item Quality-of-Life (QOL) module has also been available for optional use in the BRFSS since January 1995. When used together, the HRQOL-4 and the supplemental 10-item module form the expanded HRQOL-14 set of questions that many states and communities are now using in their surveys, providing a large public-domain source of HRQOL population data.

The CDC HRQOL-14 questions have been validated in several studies, including ones that have cross-validating the questions with the widely-used Rand Corporation's Medical Outcomes Study Short-Form 36 (SF-36). Results to date indicate that the HRQOL-14 questions, in spite of their brevity, predict short-term mortality and hospital utilization and have reasonably good criterion validity with respect to the SF-36 in both healthy and disabled populations. The BRFSS QOL questions significantly extend the utility of the BRFSS, now administered and used by all 50 states and the District of Columbia.

The interview will only take a short time, and all the information obtained in this study will be confidential.

Section 1: Health Status

1. Would you say that in general your health is: (33)

	Please Read	
	a. Excellent	1
	b. Very good	2
	c. Good	3
	d. Fair	4
	or	
	e. Poor	5
Do not read these responses	Don't know/Not sure	7
	Refused	9

2. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good? (34-35)

a. Number of days __
b. None 88
Don't know/Not sure 77
Refused 99

3. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good? (36-37)

a. Number of days __
b. None **If Q. 2 also "None," skip next question** 88
Don't know/Not sure 77
Refused 99

4. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation? (38-39)

a. Number of days __
b. None 88
Don't know/Not sure 77
Refused 99

Supplemental Quality-of-Life Module

These next questions are about physical, mental, or emotional problems or limitations you may have in your daily life.

1. Are you LIMITED in any way in any activities because of any impairment or health problem?

a. Yes	1
b. No **Go to Q. 6**	2
Don't know/Not sure **Go to Q. 6**	7
Refused **Go to Q. 6**	9

2. What is the MAJOR impairment or health problem that limits your activities?

Do Not Read. Code Only One Category.

a. Arthritis/rheumatism	0 1
b. Back or neck problem	0 2
c. Fractures, bone/joint injury	0 3
d. Walking problem	0 4
e. Lung/breathing problem	0 5
f. Hearing problem	0 6
g. Eye/vision problem	0 7
h. Heart problem	0 8
i. Stroke problem	0 9
j. Hypertension/high blood pressure	1 0
k. Diabetes	1 1
l. Cancer	1 2
m. Depression/anxiety/emotional problem	1 3
n. Other impairment/problem	1 4
Don't know/Not sure	77
Refused	99

3. For HOW LONG have your activities been limited because of your major impairment or health problem?

Do Not Read. Code using respondent's unit of time.

a. Days	1 _ _
b. Weeks	2 _ _
c. Months	3 _ _
d. Years	4 _ _
Don't know/Not sure	7 7 7
Refused	9 9 9

4. Because of any impairment or health problem, do you need the help of other persons with your PERSONAL CARE needs, such as eating, bathing, dressing, or getting around the house?

a. Yes	1
b. No	2
Don't know/Not sure	7
Refused	9

5. Because of any impairment or health problem, do you need the help of other persons in handling your ROUTINE needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?

a. Yes	1
b. No	2
Don't know/Not sure	7

Refused 9

6. During the past 30 days, for about how many days did PAIN make it hard for you to do your usual activities, such as self-care, work, or recreation?
   a. Number of days ___ ___
   b. None 8 8
      Don't know/Not sure 7 7
      Refused 9 9

7. During the past 30 days, for about how many days have you felt SAD, BLUE, or DEPRESSED?
   a. Number of days ___ ___
   b. None 8 8
      Don't know/Not sure 7 7
      Refused 9 9

8. During the past 30 days, for about how many days have you felt WORRIED, TENSE, or ANXIOUS?
   a. Number of days ___ ___
   b. None 8 8
      Don't know/Not sure 7 7
      Refused 9 9

9. During the past 30 days, for about how many days have you felt you did NOT get ENOUGH REST or SLEEP?
   a. Number of days ___ ___
   b. None 8 8
      Don't know/Not sure 7 7
      Refused 9 9

10. During the past 30 days, for about how many days have you felt VERY HEALTHY AND FULL OF ENERGY?
   a. Number of days ___ ___
   b. None 8 8
      Don't know/Not sure 7 7
      Refused 9 9

ENDQOLMOD.00Q

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Utilizing Technology to Promote Quality Assurance and Quality Improvement Activities in Rehabilitation Facilities (NCSOCRC)

Protocol No.: 05-TATTR211-05

Date: March 12, 2008

Protocol Title: Utilizing Technology to Promote Quality Assurance and Quality Improvement Activities in Rehabilitation Facilities (NCSOCRC)

Principal Investigator: Eric S. Muncert

Protocol Executive Summary:

This research study was a continuation of an existing protocol to determine if using telecommunications and computing technologies was cost-effective, educational, and enhanced collaboration among rehabilitation centers. Research for this protocol continued in 2007 with the broadcast of Saint Francis University staff presenting three one-hour Microsoft workshops via video teleconferencing (VTC) to the nine members of the National Consortium of State Operated Comprehensive Rehabilitation Centers (NCSOCRC). The nine state related centers serve clients in rural and medically underserved areas throughout the United States. The VTC equipment and technologies necessary to broadcast these courses were previously installed throughout the NCSOCRC by the National Telerehabilitation Service System (NTSS). The use of the CERMUSA Tandberg Multipoint Control Unit (MCU) established communication links throughout the NCSOCRC. Testing continued with this technology, utilizing Internet Protocol (IP) which can further reduce connectivity expenses. Individuals participating in the workshops registered through WebCT and completed a survey following the conclusion of the workshops. Participants evaluated the overall activity and items were scored on a five point Likert Scale.

Introduction:

The NTSS initiative capitalizes upon the extremely successful results of a collaborative proof-of-concept telerehabilitation research study carried out by CERMUSA with the Hiram G. Andrews Center (HGAC), located in Johnstown, Pennsylvania. A member of the NCSOCRC, HGAC is a state-operated comprehensive rehabilitation facility that does not discriminate to individuals with disabilities. The recent convergence of telecommunications and computing technologies has provided the opportunity to develop new, innovative, and cost-effective strategies to support, promote, improve, and advance services for persons with disabilities.

Initially, the NCSOCRC was comprised of nine state-operated rehabilitation centers located in Arkansas, Georgia, Kentucky, Maryland, Michigan, Pennsylvania, Tennessee, and Virginia. The West Virginia rehabilitation center closed June 2007 due to a reduction in the budget for rehabilitation programs. The NCSOCRC's mission is "to promote and assure quality rehabilitation services at America's state operated, comprehensive rehabilitation centers that result in employment and independence for individuals with disabilities" (NCSOCRC, 1995). The Americans with Disabilities Act (ADA) requires public facilities and agencies to provide reasonable accommodations for people with disabilities. "Reasonable accommodations" are defined as modifications to policies, practices, and procedures that will allow services to be provided to persons with disabilities (ADA, 1990).

It is believed the telecommunications technology among comprehensive rehabilitation centers will continue to increase the sharing of expertise and/or model programs in staff development between centers.

This protocol used telecommunications and computing technologies to allow occupational therapists, recreation therapists, instructors, rehabilitation counselors, and directors of vision impairment programs to share information and resources. "Video teleconferencing is the two way transmission of both audio and video between the interaction of two or more sites for college classes, virtual field trips, school meetings, healthcare workshops, and industry and business meetings from different areas of the world. This technology brings the world to our door" (Impact Learning Center, 2003). This protocol is also designed to facilitate and/or improve administrative communication and/or screening activities among facilities. The lessons learned in this protocol demonstrate to staff members of the various NCSOCRC that efficient and cost-effective education alternatives for sharing information can be developed. "The NTSS has provided each of the nine centers with telecommunication technology to link the centers for staff education and video teleconferencing purposes" (David Holmes, Superintendent, Tennessee Rehabilitation Center and NCSOCRC Chairman, NTSS news, 2005). Distant learning collaborations between and among educators and students creates an ability to share knowledge through a "network of regional networks" intended to improve access to, and the quality of, educational offerings provided for schools, as well as graduate and professional school preparation (Kentucky Department of Education, 2003).

During the 2007 research period, the NTSS continued to build its relationship with the NCSOCRC. Broadcast from Saint Francis University, staff presented three one-hour Microsoft workshops via VTC to the eight members of the NCSOCRC.

Workshops completed within the protocol included:

- Microsoft Access Overview
- Microsoft Access Queries
- Microsoft Access Forms and Reports

Methods:

The continuation of the project studied the impact of utilizing technology to promote and enhance administrative communications, share telemedicine applications and technologies, assist in the development of educational environments, and provide clinical dialogue, quality assurance and quality improvement activities in and among rehabilitation facilities, specifically the NCSOCRC.

The provided telecommunications and computing technologies allow therapists, instructors, clinicians, counselors, other staff members and NCSOCRC directors to share information and resources. The equipment necessary for video teleconferencing was previously installed throughout the NCSOCRC by the NTSS. The use of the CERMUSA Tandberg MCU establishes communication links throughout the NCSOCRC. Testing continued with this technology utilizing IP. Seven of the nine centers now are able to communicate between each other over the Internet. Woodrow Wilson Rehabilitation Center in Virginia is connected their state's computer server. They have a firewall established that is proprietary of their state's information technology department and has refused participation over their network.

Subjects participating in the study were staff members or contract employees at each NCSOCRC facility who evaluated the technology or education and its application related to the research protocol and their individual job responsibility. Subjects were over 18 years of age. Recruitment for participation in the research is based upon the content matter of the video teleconference and participation is determined by the directors of each facility.

Results and Analysis:

Individuals participating in the workshops registered through WebCT and completed a survey following the conclusion of the workshops. Participants evaluated the overall activity and items were scored on a five point Likert Scale. : All of the workshops were evaluated and overall responses from each indicated an above average rating in most areas, these were indicated in the *Excellent* and *Very Good* responses.

Using a five point Likert Scale: 5 = Excellent; 4 = Very Good; 3= Good; 2 = Fair; 1 = Poor; each participant evaluated the following:

N= 46

Questions	Likert Rating
1. How well the activity met the stated learning objectives	3.83
2. How well the activity related to your position duties	4.28
3. How well the activity will help you improve your position duties	4.30
4. How well the instructor conveyed the subject matter	4.43
5. The overall quality of the activity	4.37

Key Research Accomplishments:

The accomplishments from this research include:

- Determined benefits from using video teleconferencing within the NCSOCRC.
- Determined cost-effectiveness of video teleconferencing between the NCSOCRC located in eight states.
- Determined practicality of utilizing video teleconferencing technology between the centers.
- Determined if telecommunications assists in facilitating and enhancing administrative, clinical dialogue, and quality assurance among the eight member centers of the NCSOCRC throughout the United States.

Reportable Outcomes:

The ability of providing technologically and visually appealing, innovative, and cost-effective education programs in 2007 was tested in rehabilitation centers. Utilizing video teleconferencing and computing technologies to enhance education for their staff through the use of the Tandberg MCU, Saint Francis University's Instructional Technology Specialist conducted three different one-hour Microsoft Access workshops that were broadcast throughout the NCSOCRC. The different workshops were broadcast on separate days throughout 2007. One hundred thirteen (113) individuals registered via WebCT, accessed the class materials on the Internet, and participated in the continuing education workshops. Forty-six participants voluntarily participated in the research study and completed the Software Education Questionnaire. Inquiry was made why the low return of surveys, and the responses varied from: "completed it for the other workshops, nothing changed, forgot to distribute them, and participants didn't want to." Barry Newill, Director, Carl D. Perkins Comprehensive Rehabilitation Center, Kentucky stated, "This represents a daily savings of $150 per employee, had this type of training been held away from our facility. The costs for travel, food, and class registration have been saved. If the employee received the training at an offsite location, depending upon their grade, the salary expense would also be lost." (Barry Newill, Director, Carl D. Perkins Comprehensive Rehabilitation Center, Telephone conversation, 2007) This represented a savings of $16,950 throughout the consortium.

A project the NCSOCRC planned was not initiated. It was the desire of the consortium to develop specific distance learning workshops in areas of expertise at each center that could be offered to all consortium member centers to help meet staff training needs. Developed from within the consortium, and shared via video teleconferencing, the "NCSOCRC Training Academy" never came to fruition because of lack of time and interest from member centers. The use of the technology has continued with each center's director and designated staff participating in quarterly, or as needed, administrative meetings. These have been successful using the MCU and IP.

Conclusions:

The protocol demonstrated to staff members of the NCSOCRC that efficient and cost-effective education alternatives for sharing information can be developed. Video telecommunications increases access to healthcare and education in isolated, rural, and underserved communities. Sharing areas of expertise or model programs remotely using technology results in reduction of center costs for employee training and education. The technology and research initiatives for this protocol have been explored, tested, and evaluated. The protocol was discontinued March 11, 2008.

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National Telerehabilitation Service System

Software Education Workshop Questionnaire to the
National Consortium of State Operated Comprehensive Rehabilitation Centers
Project Title: Utilizing Technology to Promote Quality Assurance and Quality Improvement Activities in Rehabilitation Facilities (NCSOCRC)

Project Number: 05-TATTR211-05

Confidential feedback from you is requested regarding the video teleconferencing software education workshop provided to your center through the National Telerehabilitation Service System. Please answer the questions below. Your comments are welcomed and appreciated.

1. Rate the effectiveness of how well the activity met the stated learning objectives:
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

2. Rate the effectiveness of how well the activity related to your position duties:
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

3. Rate the effectiveness of how well the activity will help you improve your position duties:
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

4. Rate the effectiveness of how well the instructor conveyed the subject matter:
   a. Excellent
   b. Very Good
   c. Good
   d. Fair
   e. Poor

5. Rate the overall quality of the activity:
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

6. As a result of the activity, did you learn something new or verify information you already knew?
    a. Learned something new
    b. Verified prior knowledge

7.

8. Would you participate in future computer software trainings?
    a. Yes
    b. No

9. Suggestions for future courses:

Thank you for taking the time to complete this questionnaire. Please return to Eric Muncert by either of the following ways:

- **Competing survey on WebCt**

  or
- **Return via email to: emuncert@cermusa.francis.edu**

  or
- **Fax to (814) 255-9212**

  or
- **Postal mail to: Eric Muncert, NTSS Site Manager**
  727 Goucher Street
  Johnstown, PA 15905

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

Protocol No.: 05-TATTR212-05

Date: March 12, 2008

Protocol Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

Principal Investigator: Eric Muncert

Protocol Executive Summary:

Obesity is an abnormal accumulation of body fat, being more than 20 percent above ideal body weight, frequently resulting in an impairment of health (National Institute of Health, 2001). "Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles" was a research study designed to educate obese (overweight) students with disabilities about proper nutrition and healthy living habits that could decrease body mass weight and improve the student's mental health and academic performance. The National Telerehabilitation Service System (NTSS) partnered with the Hiram G. Andrews Center (HGAC), in Johnstown, Pennsylvania. The Allied Health Division within HGAC assisted implementing the twelve week telehealth research project that began in January 2007. The research study was designed to assist in the development of a life skills course initiated at HGAC for students who desire to improve their health through education and nutrition. Certified nutritionists and physical therapists from the HGAC assisted in educating and instructing the students. Student's progress in body mass weight reduction, as well as blood pressure levels, was tracked using telerehabilitation technology and the LifeSource Weight Diary and Blood Pressure Diary software. Telecommunications and software computer technologies were used to enhance the education between the student and a professional instructor or licensed healthcare provider.

Introduction:

Obesity is a disease that affects nearly one-third of the adult American population (approximately 60 million people). The number of overweight and obese Americans is steadily rising since 1960. Today, nearly 64.5 percent of adult Americans (about 127 million people) are categorized as being overweight or obese. Each year, obesity appears to be the cause of at least 300,000 deaths in the United States and healthcare costs of American adults with obesity amount to approximately $100 billion (American Obesity Association, 2005). Among adults with disabling conditions, 24.9% were obese compared to 15.1% among those without disabilities. (Weil, et al. 2002).

We need fat tissue because it acts as an energy reserve and for the absorption of some of the nutrients such as vitamins. In addition, fat also has insulating properties. However, excess body fat leads to obesity. Obesity is a serious condition that affects over a quarter of the adults in the United States. Next to smoking, obesity is the second leading cause of premature/untimely death. Obesity also increases the risk of developing conditions such as high blood pressure, diabetes, heart disease, stroke, and cancer of the breast, prostate, and colon. Lack of the physical activity, coupled with high calorie diet, can lead to weight gain and eventually to obesity. However, if maintained, weight losses as small as 10 percent of the body weight can improve an individual's health.

The primary developmental disabilities that result in limited mobility could lead to obesity and eventual physical limitations. Although limited, research done using subjects such as adults with developmental disabilities supports this argument. Obesity has an adverse effect on the quality of life (Surgeon General Call to Action, 2002) and personal behavior (ADA Position Paper, 1997). Besides limited mobility and physical endurance, indicators such as social and job place discrimination assert these conclusions. Persons with developmental disabilities are at an increased nutritional risk because of feeding problems, drug-nutrient interactions, metabolic disorders, decreased mobility, and altered growth patterns. In addition, they may also be at risk due to insufficient income, limited nutritional knowledge, and/or caregivers who may not provide an environment that promotes the intake of a nutritionally adequate diet.

Can obesity be considered as a disability? The Americans with Disabilities Act (ADA) states that employers covered by the statute may not discriminate against a qualified individual with a disability with respect to employment matters. The ADA also requires public facilities and agencies to provide reasonable accommodations for people with disabilities. "Reasonable accommodations" are defined as modifications to policies, practices, and procedures that will allow services to be provided to persons with disabilities. One type of claimed disability that is increasingly the subject of litigation is obesity. Although initially reluctant to recognize obesity as a qualifying disability for purposes of ADA protection, courts now are increasingly willing to consider obesity as a disability, giving plaintiffs status to raise ADA claims (ADA, 1990).

CERMUSA, in Loretto, Pennsylvania, is an organization that conducts research and studies under a federal grant issued by the United States Department of Defense. Its mission is to research and promote technologies that will increase access to healthcare and educational services to residents of remote and medically under-served areas. CERMUSA endeavors to promote "telehealth" as a practical and sustainable solution to inaccessible specialty healthcare. Telehealth uses electronic information and telecommunications technologies to support long-distance clinical healthcare, patient and professional health-related education, public health and health administration (Office of the Advancement of Telehealth, 2001).

The NTSS initiative capitalizes on the extremely successful results of a collaborative proof-of-concept telerehabilitation research study between CERMUSA with HGAC in 1999. The recent convergence of telecommunications and computing technologies has provided the opportunity to develop new, innovative, and cost-effective strategies to support, promote, improve, and advance services for persons with disabilities.

The research will use computer software to monitor student activities to reduce body mass weight. This protocol plans to use telerehabilitation technologies that will allow physical therapists, recreation therapists, instructors, and nutritionists the opportunity to educate students about the importance of maintaining an appropriate body mass index (BMI) to assist in preventing additional developmental disabilities. BMI, the measurement of choice for many physicians and researchers studying obesity, is a mathematical formula (given below) used to determine whether a person is overweight.

$$\text{BMI} = \text{Weight}_{(\text{Kg})} / (\text{Height}_{(\text{Meters})})^2 = [\text{Weight}_{(\text{lbs})} / (\text{Height}_{(\text{inches})})^2] * (704.5)$$

Students may be able to realize the importance of nutrition and education that hopefully will lead to changes that will improve their quality of life. Technology can be used to enhance the interaction between the student and instructor or healthcare provider. This study will monitor the effectiveness of supplementing conventional education on nutrition and healthy living with telehealth technology.

It is believed that the use of weight management software applications, in conjunction with well-being and nutrition education, will maintain or decrease the BMI of obese persons with a disability.

Methods:

The study will determine if students are able to identify the effectiveness of nutrition education and healthy living education, which could improve the quality of their life. The computer technologies will offer physical therapists, recreation therapists, and instructors, nurses, and nutritionists' opportunities to educate students in maintaining an appropriate BMI, thereby helping to prevent additional developmental disabilities. The research study is to test the modern technologies that monitor student activities to reduce body mass weight. Blood pressure will be measured each week using an A & D Medical Blood Pressure Monitor. BMI will be measured each week using Spenser Bod-E Comm XL Body Weight and Body Fat Meter. A wheelchair accessible Detecto weight scale will measure body weight during the program. Data collection will be entered into the A & D Medical Blood Pressure and Weight Diary software program. Professional nutritionists, physical therapists, registered nurses, and other guest speakers will use telecommunications and computing technologies throughout the program to assist them in educating students. Subjects participating in the study must be 18 years or older and students from HGAC. HGAC provides services to people with disability, offering a comprehensive program of services that integrates education, counseling, evaluation, and therapy in a barrier-free environment. Subjects will be invited to attend a free informational program to learn about a new Nutrition/Healthy Living Education Program to begin in January 2007. The attached flier will be posted throughout the HGAC facility (Appendix A). This flier will be posted in the classroom halls, recreation hall, cafeteria, Courtyard Café, and dormitory bulletin boards. Each student will receive a copy of the flier in their HGAC mailbox. As an interested participant, students will be asked to telephone the NTSS at 814-255-9200 and leave their contact information. Participation by prospective subjects will be solicited and received by project staff at HGAC. Project staff will determine if potential subjects meet entrance criteria. The Primary Investigator will contact these individuals to further explain the research protocol and schedule an appointment to obtain their signed informed consent (Appendix B). Once informed consent is obtained, data regarding BMI will be collected from the participant. The first 25 participants meeting inclusion and exclusion criteria will be utilized in the study. No other uses of the informed consent will be discussed. If the participant agrees to have photographs taken for documentation purposes, he/she will be asked to complete an Audio/Video/Photo Consent to Participate form (Appendix C). The program will be explained to the students and informed consent will be given. Inclusion/Exclusion criteria include:

Inclusion criteria:

- Age 18 years or older of either gender.
- Student of HGAC.

- Informed written consent to participate in the study.
- Subject with Body Mass Index (BMI) of 30 or greater.

Exclusion criteria:

- Subject who is under 18 years of age.
- Subject who is not a student of HGAC.
- Subject with BMI of 29.9 or less.

The resident population at the Hiram G. Andrews Center averages 255 clients. It is anticipated that 10% (~25 clients) will agree to participate in the pilot study. It is also anticipated that 20% or 5 clients, may not meet the inclusion criteria or complete the entire study. A convenience sample of twenty participants will be obtained from the study body of HGAC. There will be no discrimination as to gender, racial/ethnic distribution, or English/Non-English speaking participants.

Results and Analysis:

- Stage I: 2 weeks
  The NTSS, HGAC's Allied Health Care, and a professional nutritionist and physical therapist from HGAC completed a twelve week life skills program agenda for students who are obese and have a disability.
- Stage II: 3 weeks
  The NTSS and HGAC's Allied Health Care developed and distributed a flier announcing the life skills program. This recruiting tool was distributed to all HGAC students via their personal mail box at HGAC. (Appendix A)
- Stage III: 4 weeks = 1 month
  Invited all interested students to a meeting. Review the informed consent, inclusion and exclusion criteria, and explain the monitoring and measurements that will be taken by a registered nurse during the study. Explain the outcomes desired by their participation in the program. Review program agenda with students. Establish personal goals with each student participating in the program during the twelve week testing period. (Appendix B)
- Stage IV: month 2
  Introduce the students to the technology that will be used, the registered nurses, the nutritionist and physical therapist who will be assisting with the program. Take initial BMI and blood pressure measurements. Review the program agenda for the next meeting and review personal goals established by the student. This assessment will be completed by the registered nurse and the student.
- Stage V: 6 – 16 weeks = month 2 , 3, and 4
  Continue recording BMI and blood pressure measurements for the remainder of the twelve week research period. Throughout this period, professional nutritionists, physical therapists, registered nurses, and other guest speakers will provide information to the students throughout the program.

- Stage VI: 16 weeks = month 4
  Conclude the twelve week research program. Participants to complete survey. (Appendix D)

- Stage VII: month 8 – Distribute 3 month questionnaire to participating students. (Appendix E)
- Stage VIII: month 11 – Distribute 6 month questionnaire to participating students. (Appendix E)
- Stage IX: month 12 – Develop End of Year report delineating the effectiveness and outcomes obtained and evaluate the reliability and significance of the computing telehealth technologies used.

The number of students meeting the inclusion criteria with a BMI of 30 or greater was 7. Survey responses at the end of the 12 week research program are shown below:

N = 7

Questions	Yes / No
1. Were your expectations of participating in the program met?	7 / 0
2. Was the Weight Diary and Blood Pressure Diary software easy to use and understand?	4 / 3
3. Has the use of a computer increased your awareness of proper nutrition?	6 / 1
4. Did the use of the Weight Diary and Blood Pressure Diary encourage you to make healthier choices?	3 / 4
5. Did this program encourage you to continue making healthier lifestyle choices?	7 / 0
6. Did you participate in this program because you want to live healthier?	7 / 0
7. Would you like a program like this to continue?	7 / 0

The 3 and 6 month survey was added after the protocol was initiated. During that time period, five of the participants graduated, quit, or were dismissed from school for reasons unknown. Survey responses at 3 and 6 months after participating in the program:

N = 2

Questions	Yes / No
1. Have you used the education you received from the program to maintain or improve a healthier lifestyle.	2 / 0
2. Are you more aware now of your eating habits?	2 / 0
3. Have you used the Internet to increase your awareness of proper nutrition?	1 / 1

4. Have you monitored your weight since participating in the program?	2 / 0
5. Did this program encourage you to continue making healthier lifestyle choices?	2 / 0
6. Did you participate in this program because you want to live healthier?	2 / 0
7. Would you participate in a Nutrition and Healthy Living Education Program again?	2 / 0

Blood Pressure and Body Mass Index measurements were taken each week. There was a decrease in Blood Pressure and Body Mass Index in 6 of the 7 of the students through the 12 week period.

Students = 7	**Blood Pressure** Before ± After = Change	**Body Mass Index** Before ± After = Change
1	124/84 ± 118/78 = (-6/6)	36.9 ± 36.5 = (-.4)
2	126/88 ± 122/84 = (-4/4)	36.3 ± 36.0 = (-.3)
3	126/84 ± 116/72 = (-10/12)	31.9 ± 32.7 = +.8
4	130/80 ± 116/80 = (-14/0)	36.0 ± 36.1 = (-.1)
5	152/98 ± 128/88 = (-24/10)	40.2 ± 40.6 = +.4
6	134/98 ± 122/84 = (-12/14)	31.7 ± 32.4 = +.7
7	132/84 ± 140/90 = +12/14	41.7 ± 40.8 = +1.0

Key Research Accomplishments:

The primary goal of our study was to make HGAC population aware of the importance of weight control and to adopt a healthy lifestyle. We feel that this goal was achieved. What is more, two subjects have continued to maintain their weight. The participants were actively interested in maintaining their weight, and as a result of which self esteem was also improved. We wanted to expand this program to several other centers. Due to the lack of interest on their part, this idea was dropped. On a more positive note: These observations have led the HGAC management to initiate a weight management program, measure of a true success.

Reportable Outcomes:

A poster describing the protocol has been accepted for presentation at the American Telemedicine Association's 2008 Annual Meeting in Seattle Washington.

Conclusions:

This pilot research study sought to determine that through education and the monitoring of the BMI of persons with disabilities, the risk of obesity becoming a developmental disability could be reduced and would not precipitate secondary conditions such as diabetes, heart disease, and hypertension. In addition, students would be able to identify the effectiveness of nutrition and education to improve their quality of life. Technology was used to enhance the education between the student and instructor. Since the sample size for this study was small, one should exercise caution in drawing any conclusions. However, the observations give a clue or show trend. We made several interesting observations: e.g.: not all of the students were computer literate. This proved to be a hindrance in obtaining the required information for the study. The protocol was shared with the Woodrow Wilson Rehabilitation Center in Virginia, and the Carl D. Perkins Comprehensive Rehabilitation Center in Kentucky. The intention was to have the students participate in the protocol with students from the other centers in FY07. However, due to changes in staffing and lack of students willing to participate at the centers, this contributed in making the decision not to continue the study.

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You're Invited!!!

All *XXXX* Students

Come learn about a new

Nutrition/Healthy Living

Education Program

Being offered to all *XXXX* students

Through this program you will:

- Learn about **healthy lifestyles**
- Learn about ways to **conquer obesity**
- Track and monitor your progress using **computer technology**

When:	***TDB***
Where:	***TBD***
Time:	**5:00 p.m. – 6:00 p.m.**

Sponsored by:

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NTSS

HCA

Appendix B

INFORMED CONSENT FORM
TO PARTICIPATE IN A RESEARCH STUDY

Project Title: Rural Health, Center of Excellence for Remote and Medically Under-Served Areas

Study Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

Principal Investigator:

Eric S. Muncert/Site Manager
Saint Francis University
CERMUSA
117 Evergreen Drive
Loretto, PA 15940
Phone: (814) 255-9200

You are being asked to participate in a research study conducted at CERMUSA's National Telerehabilitation Service System (NTSS) in Johnstown, Pennsylvania by Eric S. Muncert, Camille M. Wendekier, Barbara R. Demuth and Brenda K. Cover. This study is sponsored by the Telemedicine and Advanced Technology Research Center (TATRC) section of the Department of Defense U.S. Army Medical Research and Materiel Command (USAMRMC), with the support of Saint Francis University in Loretto, Pennsylvania.

The NTSS will partner with the Hiram G. Andrews Center (HGAC), located in Johnstown, Pennsylvania. The Allied Health Division within HGAC will assist in the implementation of the proposed twelve week telehealth research project. Certified nutritionists and physical therapists from the center will assist educating and instructing the students. The pilot research study is designed to assist in the development of a life skills course initiated at HGAC for students who desire to improve their health through education, and nutrition. Monitoring of the student's progress in body mass weight reduction, as well as blood pressure levels, will be tracked using telerehabilitation technology and the LifeSource Weight Diary and BP Diary software. Telecommunications and computing technologies will be used to enhance the education between the student and a professional instructor or licensed healthcare provider. The blood pressure reading will be taken by using the A & D Medical BP monitor.

Taking part in this research is entirely voluntary. You do not have to participate in this study. You should read the information below, and ask questions about anything you do not understand before deciding whether or not to participate.

PURPOSE OF THE STUDY

The research study is to determine if education on nutrition will improve the quality of life for you. This research study uses computer technologies to allow physical therapists, recreation therapists, and instructors, nurses, and nutritionists opportunities to educate you in the importance of maintaining an appropriate weight to help prevent you from developing additional conditions that may cause you further disability. Monitoring your progress in preventing weight gain, as well as blood pressure levels, will be tracked using the LifeSource Weight Diary and BP Diary software.

This research also is measuring how you like using the LifeSource Weight Diary and BP Diary software. We will also measure how much you use the software.

PROCEDURES

To join the study you must be a student of Hiram G. Andrews Center (HGAC) and be at least 18 years old. You also must have a body mass index (BMI) of 30 or greater. Height and weight are used to calculate BMI. If you have a BMI less than 30, are less than 18 years of age, or are not a student of HGAC you cannot participate in this study. Approximately 20-25 students will join this study.

You will meet with the Principal or Associate Investigator and read and ask any questions concerning this Informed Consent. After signing the consent form, you may return to the Investigator you have met with.

If you volunteer to participate in this study, we would ask you to do the following things:

You will attend a free weekly informational program from 6:00p.m. till 7:00p.m. at the Hiram G. Andrews Center (HGAC) to learn about a new Nutrition/Healthy Living Education Program. These classes will be in the National Telerehabilitation Service System Software Testing and Evaluation Laboratory located within HGAC. You will attend a total of 12 nutrition classes for this study.

Your BMI and blood pressure levels will be checked and tracked once a week and will be entered into a computer program. You will do this for 12 weeks, the length of the class. This is part of the Nutrition/Healthy Living Education Program. You will be asked to complete an anonymous survey at the end of the class, and at three and six months after participating in the Nutrition and Healthy Lifestyles Education Program. This survey will assist in determining if the education/information you received during in the Nutrition and Healthy Lifestyles Education Program is utilized.

The blood pressure reading will be taken by using the A & D Medical BP monitor. You will be seated and instructed to rest your forearm on a table. If you have a medical condition such a mastectomy, proper precautions will be followed when placing the blood pressure cuff on your arm. While the cuff is on the arm, the licensed healthcare provider will inflate the cuff and instruct you to relax while the machine is obtaining the blood pressure reading. Results will be entered into the A & D Medical BP software diary.

An analysis and explanation of data will be performed during each intervention with the subject and Registered Nurse and Professional Nutritionist. At the end of the research, an analysis of all the data will be compiled by the Principal Investigator. You may receive information regarding the purpose and results of the study when it is complete.

No special precautions should be observed before or after the study.

Very few, if any, nutrition classes are specifically for people with disabilities. This research study is evaluating the effect of using telemedicine in nutrition classes specifically for people with disabilities.

POTENTIAL RISKS AND DISCOMFORTS

You will not be at any physical risk. The particular treatment or procedure may involve risks to you which are currently unforeseeable.

This program will not talk about exercise. If you have any questions about increasing your activity, ask your doctor these questions. There is a risk that increasing your activity may not be good for your health. You must talk to your doctor before increasing your activity. Your doctor must agree to your increased activity so that you do not harm your health.

You may become frustrated if the technology does not work as expected.

ANTICIPATED BENEFITS TO SUBJECTS

You will be able to monitor your blood pressure and your weight. By watching these things, you might be able to improve your health. You will be able to talk to a professional nutritionist and a Registered Nurse about health information regarding general weight and blood pressure. This information may help you manage your weight and blood pressure. You must inform your doctor if your blood pressure is too high or low. You must ask your doctor any questions about medicines or your medical care. The nutritionist and Registered Nurse can only give you information about your weight and blood pressure, they cannot give you any advice on treatment. You must go to your doctor with any questions or concerns you have about your weight or blood pressure measurements.

You may also learn more about nutrition. This may improve your health.

There will be no other benefits to you, other than knowing you have contributed to science.

Contact the Principal Investigator if you would like the results of the research.

ALTERNATIVES TO PARTICIPATION

If you choose not to participate in the study, you may want to consult your doctor for information concerning your BMI and nutrition.

PAYMENT FOR PARTICIPATION

There is no fee or other compensation for participating in this study.

MEDICAL CARE FOR RESEARCH RELATED INJURY

In the unlikely event you become injured as a result of your participation in this study, Saint Francis University will make every effort to assist you in obtaining medical care. The costs of this medical care will be billed to you or your insurance company. If you want more information about this, please contact Eric Muncert, PI, at 814-255-9202.

CONFIDENTIALITY

We will protect your personal privacy as much as possible. Your name or identifying information will not be included in any report or presentation Authorized Saint Francis University personnel may have access to your data in order to assure that your rights are safeguarded. All surveys, data, and documents with any identifying information will be stored in locked file at CERMUSA.

Computer data files are stored in compliance with security procedures with HIPAA regulation. This authorization does not have an expiration date. All data will be kept in a locked file cabinet and maintained in a designated place in Saint Francis University's CERMUSA office and will be retained for three years.

Other than BMI measurements and the blood pressure readings collected in the classes, CERMUSA researchers will not have access to your health records. Persons and groups authorized to receive this Protected Health Information (the BMI measurements and blood pressure readings collected in the study) include committees and individuals involved in research oversight (CERMUSA and USAMRMC), including their Institutional Review Board. You should take as much time as you need to decide whether you wish to permit the use and disclosure of your Protected Health Information for the Research Study. Please feel free to ask questions about any aspects of this authorization that are unclear to you.

You are not required to participate in the study and share your Personal Health Information. You may refuse to do so at any time. Healthcare providers may not refuse to provide you treatment or other healthcare services if you do not consent to these terms. However, if you don't want to share this information, you can elect not to participate in the research study. If you decide you do not want to share this Personal Health Information, please contact Eric S. Muncert at (814) 255-9200 to tell him that you want to quit the study.

All data and medical information obtained about you, as an individual, will be considered privileged and held in confidence; you will not be identified in any presentation of the results. Complete confidentiality cannot be promised to subjects, particularly to subjects who are military personnel, because information bearing on your health may be required to be reported to appropriate medical or command authorities.

Representatives of the U.S. Army Medical Research and Material Command (USAMRMC) are authorized to review research records as part of their responsibility to protect human research volunteers. LifeSource Weight Diary and BP Diary software is being used to monitor body mass weight reduction, as well as blood pressure levels. As a result, your name may be seen but all involved are bound by rules of confidentiality not to reveal your identity to others.

PARTICIPATION AND WITHDRAWAL

Your participation in this research is voluntary. If you choose not to participate, that will not affect your relationship with Saint Francis University's CERMUSA or your right to healthcare or other services to which you are otherwise entitled. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without prejudice. You may quit the study by contacting the Principal Investigator, Eric S. Muncert at (814) 255-9200 or by email at emuncert@cermusa.francis.edu to be removed from the study.

The study may obtain audio, photo, video, or other electronic images of you for research documenting or public relations purposes. A separate consent form titled "Audio/Video/Photo Consent to Participate" will be provided if audio, photo, video, or other electronic images of you would be obtained. You have the choice to give or not give permission for the use of your pictures or recordings in the study. You can make this choice on the "Audio/Video/Photo Consent to Participate" form provided to you. (Appendix D)

CONSEQUENCES OF WITHDRAWAL

You may withdraw form the research at anytime. Your medical care or relationship with HGAC will not change if you quit the study.

WITHDRAWAL OF PARTICIPATION BY THE INVESTIGATOR

The only time the principle investigator will withdraw you from the study is if this research project is terminated before the twelve weeks, due to reasons such as lack of funding.

NEW FINDINGS

During the course of the study, you will be informed of any significant new findings (either good or bad), such as changes in the risk or benefits resulting from participation in the research or new alternatives to participation that might cause you to change your mind about continuing in the study. If new information is provided to you, your consent to continue participating in this study will be re-obtained.

IDENTIFICATION OF INVESTIGATORS

In the event of a research related injury or if you experience an adverse reaction, please immediately contact the investigators listed below. If you have any questions about the research, please feel free to contact the Principal Investigator, Eric S. Muncert, at (814) 255-9200.

RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have any questions about the research project, you can contact Eric S. Muncert at the Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA) at 814-255-9200. In the event that technical difficulties should occur, CERMUSA's technical staff can be reached at 800-901-5583. You can contact the SFU IRB Administrator at (8140 472-3089. If you have questions about your rights as a study subject, you may contact Bernadette A. Yeager, CERMUSA Research Logistics Specialist, at 814-472-3389.

SIGNATURE OF RESEARCH SUBJECT

I have read the information provided above. I have been given an opportunity to ask questions and all of my questions have been answered to my satisfaction. I consent to participate in this research study and will receive a copy of this form for my records.

____

Signature of Subject

____ ________________

Printed Name of Subject Date

____

Address

SIGNATURE OF PERSON EXPLAINING CONSENT AND AUTHORIZATION

I have carefully explained to the subject the nature and purpose of the above study. The subject, by signing this form, has been given enough time and an adequate place to read and review this form. There has been an opportunity to ask questions and receive answers regarding the nature, risks, and benefits of participation in this research study. The subject appears to understand the nature and purpose of the study and the demands required of participation. My signature as witness certifies that the subject signed this consent form in my presence as his/her voluntary act and deed.

____

Signature of Person Explaining Consent and Authorization

____ __________________

Printed Name of Person Explaining Consent and Authorization Date (same as subject's)

SIGNATURE OF INVESTIGATOR

____

Signature of Investigator (If Not Person Explaining Consent)

____ __________________

Printed Name of Investigator Date

Appendix C

AUDIO/VIDEO/PHOTO CONSENT TO PARTICIPATE

Study Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

You are asked to participate in a research study conducted at Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas by Eric Muncert, Primary Investigator. Your participation in this study is voluntary. Please read the information provided on the **Consent to Participate in Research** form, and ask questions about anything you do not understand, before deciding whether or not to participate. *(Check appropriate box below.)*

☐ **I DO CHOOSE TO PARTICIPATE** and give CERMUSA and its legal representatives, the right and permission to copyright and or/use, publish, reuse, and republish audio recordings, photographic pictures or portraits, videos, or images made of me, through any media and for whatever legal purpose CERMUSA chooses. . If I decide not to participate, I am free to withdraw my consent and discontinue participation at any time without prejudice. *(Please continue with review of this document and necessary signatures.)*

☐ **I DO CHOOSE TO PARTICIPATE IN THE RESEARCH, BUT DO NOT GIVE PERMISSION FOR THE USE OF MY LIKENESS** by CERMUSA and its legal representatives, to copyright and or/use, publish, reuse, and republish audio recordings, photographic pictures or portraits, videos, or images made of me, through any media and for any purpose. I understand that this will not affect my relationship with CERMUSA or my right to services to which I am otherwise entitled. *(Please sign at end of form and give to research investigator.)*

I hereby release, discharge and agree to save harmless CERMUSA, Saint Francis University, their representatives, assigns, employees, or any person or persons, corporation or corporations, acting under the permission of CERMUSA, including any firm publishing or distributing the finished product. *(Check box below.)*

☐ I hereby warrant that I am over eighteen years of age, and am competent to contract in my own name, insofar as the above is concerned.

Center of Excellence for Remote and Medically Under-Served Areas
P. O. Box 600, Loretto, PA 15940 Phone: (814) 472-3389 Fax: (814) 472-3377
www.cermusa.francis.edu

I understand no compensation or other consideration is offered in exchange for the use of these audio, photo, video, or other electronic images.

SIGNATURE OF RESEARCH SUBJECT

I have read the information provided regarding the research project. I have been given an opportunity to ask questions about the research, and all of my questions have been answered to my satisfaction.

Printed Name of Subject	Date

Subject's Signature

Address

SIGNATURE OF WITNESS

My signature as witness certifies that the subject signed this consent form in my presence as his/her voluntary act and deed.

Printed Name of Witness

Signature of Witness	Date (same as Subject's)

SIGNATURE OF INVESTIGATOR

Printed Name

Signature of Investigator	Date

Appendix D

National Telerehabilitation Service System

Effectiveness of Nutrition Education and Healthy Living Education Survey for Students from: Hiram G. Andrews Center, Pennsylvania

Project Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

---

Confidential feedback from you is requested regarding the nutrition and healthy living education received and the use computing and telerehabilitation technology during the twelve week period.

Please circle your YES or NO response below. Your comments are very much appreciated.

1. Were your expectations of participating in the program met?

YES NO

Comments:

2. Was the use of the Weight Diary and Blood Pressure Diary software easy to use and understand?

YES NO

Comments:

3. Has the use of a computer increased your awareness of proper nutrition?

YES NO

Comments:

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4. Did the use of the Weight Diary and Blood Pressure Diary encourage you to make healthier choices?

YES NO

Comments:

5. Did this program encourage you to continue making healthier lifestyle choices?

YES NO

Comments:

6. Did you participate in this program because you want to live healthier?

YES NO

Comments:

7. Would you like a program like this to continue?

YES NO

Comments:

Thank you for taking your time to participate in the program and completing the survey.

National Telerehabilitation Service System
727 Goucher Street
Johnstown, PA 15905

Appendix E

National Telerehabilitation Service System

Effectiveness of Nutrition Education and Healthy Living Education Survey for Students from: Hiram G. Andrews Center, Pennsylvania

Project Title: Assisting Persons with Disabilities to Conquer Obesity and Obtain Healthy Lifestyles

---

Confidential feedback from you is requested regarding the nutrition and healthy living education received when participating in the Nutrition and Healthy Living Education Program.

Please circle if this is a: **Three (3)** or **Six (6)** Month Survey

Please circle your **YES** or **NO** responses below. Your comments are very much appreciated.

1. Have you used the education you received form the program to maintain or improve a healthier lifestyle?

   YES NO

Comments:

___

___

___

2. Are you more aware now of your eating habits?

   YES NO

Comments:

___

___

___

3. Have you used the Internet to increase your awareness of proper nutrition?

   YES NO

Comments:

___

___

___

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4. Have monitored your weight since participating in the program?

YES NO

Comments:

____
____
____

5. Did this program encourage you to continue making healthier lifestyle choices?

YES NO

Comments:

____
____
____

6. Did you participate in this program because you want to live healthier?

YES NO

Comments:

____
____
____

7. Would you participate in a Nutrition and Healthy Living Education Program again?

YES NO

Comments:

____
____
____

Thank you for taking your time to participate in the program and completing the survey.

National Telerehabilitation Service System
727 Goucher Street
Johnstown, PA 15905

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Evaluation of a Combination of a Speech Generating Device and Telecommunication Equipment to Improve Quality of Life via Participation in a Support Group in Patients with Amyotrophic Lateral Sclerosis

Protocol No.: 06-TATTR225-06

Date: March 12, 2008

Protocol Title: Evaluation of a Combination of a Speech Generating Device and Telecommunication Equipment to Improve Quality of Life via Participation in a Support Group in Patients with Amyotrophic Lateral Sclerosis

Principal Investigator: Sharon Plank MD, LAc. John P. Murtha Neuroscience And Pain Institute: ***CERMUSA Collaborator:*** Brenda Guzic, RN, BSW, MA

Protocol Executive Summary:

Amyotrophic Lateral Sclerosis (ALS), often referred to as "Lou Gehrig's disease," is a progressive neurological disease. As this disease progresses, all muscles under voluntary control are affected. Individuals experience difficulty swallowing, speaking, breathing, ambulating, and initiating fine motor tasks. The American Academy of Neurology has outlined principles of ALS management with the highest priority being given to maintaining the autonomy of the Person with ALS (PALS). Support groups have shown to positively affect coping, self-concept, outlook, and relationships in a variety of diseases (i.e., breast cancer, cardiac) and these elements help to positively affect one's sense of autonomy. In November of 2004, a monthly support group was formed at the John P. Murtha Neuroscience and Pain Institute (JPMNPI). With a speech generating device (SGD), ALS patients with verbal communication difficulties can easily participate in the support group. CERMUSA and the JPMNPI have developed a "virtual" support group. The unique feature of this "virtual support group" is the linking of an augmentative and alternative communication (AAC) device that would allow a member to continue to participate even though verbal communication is lost. Through the use of a combination of video teleconferencing (VTC) equipment and a SGD, participants can attend these support groups from their own homes.

Introduction:

Amyotrophic Lateral Sclerosis (ALS), also known as Lou Gehrig's disease, is a progressive and fatal neurological disease. ALS leads to ongoing degeneration of motor neurons, which are nerve cells of the spinal cord, brain, and brainstem. Motor neurons, responsible for the control of the body's voluntary muscles, degenerate and lose the ability to send messages to muscles. The muscles then weaken and deteriorate. All voluntary muscles, those that a person consciously controls, eventually are affected and the victims of this disease are unable to move their arms, legs, and any other body part. In addition, the muscles of the chest wall and diaphragm also weaken, causing patients to rely on ventilators for breathing. Death due to respiratory failure usually occurs within three to five years after symptoms appear. It is estimated that 10 percent of people with ALS can survive for ten years or longer. Remarkably, ALS does not normally affect cognition, which allows patients to be entirely aware of their functional decline, often leading to anxiety and depression (National Institute of Neurological Disorders and Stroke, 2005).

ALS affects many individuals throughout the United States, with 5,600 new cases reported every year. Approximately 30,000 citizens have ALS in this country (ALS Association [ALSA], n.d.). With an incidence of two per every 100,000 people, it can be estimated that Pennsylvania has an incidence of 246 cases in a population of 12,284,054 (ALSA; U.S. Census Bureau, 2003). The incidence rate in Western Pennsylvania is 84 and the prevalence is 210.

There are several barriers preventing ALS patients from receiving the benefits of attending a support group. One barrier is the limited number of support groups in existence and the significant distances needed to travel to attend them. Currently, only eight support groups exist in Pennsylvania, including chapters in Allentown, Ambler, Danville, Hershey, Johnstown, Monroeville, Moosic, and Pittsburgh (ALSA, 2004). The Western Pennsylvania – West Virginia Chapter of the ALS Association provides services to 31 counties in Western Pennsylvania, with a total population area of 4,174,010. This chapter is currently serving 43 individuals in West Virginia, 133 in Pennsylvania, and generally serves 250-300 individuals in one year.

Another barrier to support group attendance is loss of physical strength with disease progression, making transfers and mobility increasingly difficult. Also, as individuals lose their ability to verbally communicate, they also lose the ability to participate in the support group. Unfortunately, many health insurances will not provide coverage for augmentative and alternative communication (AAC), and most people are unable to afford to purchase one. AAC devices facilitate communication for PALS who experience difficulty speaking. The United States Society for AAC (2005) reports that there is a wide variety of options available for AAC, ranging from communication boards, signs, gestures, and high-tech devices.

Support groups provide a valuable resource to those with mental health needs. The need for this support group is addressed in several studies which examine pain, depression, quality of life (QOL), and spirituality. Ganzini, Johnston, and Hoffman (1999) found that a large proportion of Persons with ALS (PALS) do suffer distress, reporting a significant correlation of suffering to pain, poorer QOL, hopelessness, decreased function status, and increased feeling of burden towards others. In this study, approximately two-thirds of the patients report suffering (physical, social, or psychological). In the interpretation of the results, the authors report evidence that PALS consider suffering something they experience by themselves, and when rating QOL, consider their relationships with other people. The authors found a high rate of under-treated pain and depression in this patient population, indicating a need for physicians to address pain and depression more closely (Ganzini et al.).

Doyle and Phillips (2001) closely examined AAC throughout the progression of ALS. In their examination of four case studies, they found several factors which influence what types of AAC are best for PALS. Functionally, an AAC system is largely dependent on the individual's upper extremity movement and strength. The authors found that at the beginning of the disease, most people attempt to maintain natural communication. As the disease progresses into the middle stage, PALS begin to lose movement and utilize more technology to communicate. At the end of the disease process, speech and motor control are so significantly impaired that individuals must resort back to lower technology solutions. Switches and eye gaze systems are frequently the only means of AAC at this point. In three of the four case studies, the modification of communication from high to low technology corresponded with the loss of motor skills and decreased communication topics and partners (Doyle & Phillips). Although the disease progression affects the types of AAC an individual can use, this research supports the need to continually adapt technology to meet the needs of PALS.

Prior studies have examined how a computer-based patient education system would impact QOL and frequency and duration of medication services, particularly in patients with Human Immunodeficiency Virus (HIV). Gustafson et al. (1999) were interested in developing a cost-effective program to deliver a variety of education tools to the patients. Through the Comprehensive Health Enhancement Support System (CHESS) they were able to provide in-home education tools to individuals infected with HIV. This system included commonly asked questions and answers, a library with full-text journal articles, support service information, a national service referral directory, assessment for risk reduction, decision aid, and action plan to implement decisions, online discussion groups, an expert panel, and personal stories. This system was implemented for three months to one group and six months to another group, and a control group received no intervention other than standard care for people infected with HIV. After only two months, when compared to the control group, the CHESS users reported increased cognitive function, increased physical activity, decreased negative emotions, and improved social support. When looking at ambulatory care, the control group reported lengthier visits than the experimental group. The CHESS group made significantly more telephone calls to providers, had 50 percent less hospital stays, and had shorter length of stays than the control group. When comparing the three and six month implementation times, researchers found that the six month users maintained benefits in improved QOL at a nine-month post-test, whereas the three-month group did not (Gustafson et al., 1999). In looking at how the benefits of a computer-based patient education system can be carried over for a significant period of time, one can see the benefits of initiating a virtual support group for PALS. This is extremely important because as the PALS lose additional physical abilities with time, the benefits from such a support group may be maintained even when the individuals are no longer able to physically participate. As mentioned previously, PALS can benefit from support groups, which improve QOL for persons with this disease.

The need for support groups in rural areas has been examined by other researchers as well. Beginning in May of 1996, the ALS Support Network formed by utilizing the University of Kentucky Interactive Video Network. This VTC technology allowed ALS support group members to meet over interactive video. The monthly meetings provide the ability to broadcast notes, videotapes, or slides, as well as allow for discussion among participants from any of the 13 sites through a T-1 telephone line. Participants have expressed a high level of satisfaction with this interactive video, which connects many ALS patients together (Kasarskis, Elza, Bishop, & Spears, 1997).

It is also important to examine the relationship of ALS incidence to military personnel. The ALS Association has created a document, "*ALS in the Military: Unexpected Consequences of Military Service,*" which focuses on studies that have found statistical research in this matter. In this report, they examine two separate studies which were conducted in response to reports that ALS appeared to be occurring at uncommonly high rates in young Gulf War veterans. One study funded by Veterans Affairs and the Department of Defense found that those who served in the Gulf War had double the risk of developing ALS compared to someone who had not served. This risk was found in all military branches, with the Army and Air Force having even greater risk. The second study related to the Gulf War was completed at the University of Texas Southwestern Medical Center. These researchers also found that the ALS risk of Gulf War Veterans was twice that of the general population. The report from the ALS Association also presents a study completed at Harvard University's School of Public Health. This study found that military men who served at any point in time between 1910 and 1982 are at almost 60% increased risk of ALS than those who did not serve (ALSA, 2005).

CERMUSA and the JPMNPI have partnered to provide a unique combination of technologies, termed tele-augmentative communication equipment (Tele-ACE), to allow members of the support group to attend monthly meetings virtually. AAC, laptops, access points, wireless cards, and VTC have been combined to allow PALS to participate virtually in the monthly support group held at JPMNPI. Researchers will measure the effects of the virtual support group through the Beck Depression Inventory-II, the Beck Hopelessness Scale, the McGill Quality of Life Questionnaire, and the Profile of Moods States.

Methods:

The project addresses the psychological issue of quality of life (QOL) and would allow Persons with Amyotrophic Lateral Sclerosis (PALS) to participate virtually in a support group through telecommunications technology and an AAC device. This was to be a quasi-experimental, time series design whose goal was to determine the effect of the Tele-ACE on a virtual support group of PALS. A pre-test was to be given at the start of the study, followed by post-tests at three-months, six-months, nine-months, and twelve-months.

This was to be an extension of a pilot study currently being conducted by the John P. Murtha Neuroscience and Pain Institute (JPMNPI).

The objectives of the study were:

- To evaluate adherence to a monthly ALS virtual support group
- To evaluate the value of group support via remote access in ALS patients
- To compare differences in psychological measurements within the participants of the "virtual support group"
- To evaluate the perceptions of the participants using telecommunication intervention
- To determine if psychological measurements are affected by a virtual support group

It was anticipated that there would have been nine subjects or less at any given point in time, as that is the total number of equipment devices that were available for use. Subjects would have been diagnosed with ALS, would have been at least 18 years of age and able to understand written and verbal English. Subjects could have been of either gender, and of any racial/ethnic distribution. Decisionally impaired subjects would not have been accepted into the study, and thus, there was no need for a Legally Authorized Representative to consent for them.

Subjects would have been recruited from the John P. Murtha Neuroscience and Pain Institute (JPMNPI) ALS support group, which meets monthly. A flyer would have been made available for distribution at the support group and also at the office of the Western Pennsylvania – West Virginia Chapter of the ALS Association. No other advertising for recruitment was planned. The consent precaution was that the potential subject or subject's caregiver would have contacted the research staff to inquire about enrollment in the research protocol. Thus, it would have been a decision made of the subject's own free will. Additionally, a research staff member would then have thoroughly reviewed the informed consent documents with each subject.

Patients who were interested in participating in the research protocol would have been provided information regarding the protocol. Informed consent would have been obtained as follows: the potential subject would have been approached by an associate investigator and informed consent would have been reviewed and discussed. Once the informed consent document had been reviewed, the subject would have provided consent through signature. In the event that the subject was unable to sign the document due to weakness, a "mark" would have been made with a witness signature that would also have been obtained. (The witness would not have been a member of the research staff.) The research staff member obtaining consent would also have noted the subject's agreement verbally in the subject's chart. In the event that the subject was unable to sign physically due to weakness, two witness signatures would have been required with acknowledgement noted in the subject's chart that the subject had agreed to the protocol either through verbal or other modes of communication. A Needs Assessment tool would then have been delivered at baseline to the potential subjects to determine their capability of connecting to the support group via the Internet.

If a subject was able to travel, he/she would have come to the JPMNPI to complete the informed consent process. If he/she was unable to travel, the informed consent document would have been mailed to them with a pre-addressed postage paid envelope for his/her review and signature. Prior to mailing the document, a member of the research staff would have reviewed the document with the subject to evaluate subject's understanding of the documents content and to assess the subject's competency and capacity to give informed consent. A phone number would have been given to the subject to call if he/she had any questions.

Subjects who met the inclusion criteria would then have been assigned to the same intervention. Demographic information (address and telephone number) would not have been collected for the purpose of research, however, this information is voluntarily given by participants of the support group typically when participating in the standard support group meeting. A subject ID number would have been assigned for each participant. When the research staff communicated with technical support, only the subject ID number would have been used to identify the user. Confidentiality of all subjects would have been maintained by CERMUSA researchers throughout this project.

No subject would have had access to any other subject's data. However, it should be noted that because the intervention would have required the use of VTC equipment, members of the support group would have been aware of the subject's identity. Direct access to the subject information would have been limited to the PI, AI's, and medical monitor.

This research plan is HIPAA compliant. Data collected directly from the subjects (observation, self-report screening instruments and symptom questionnaires, study-related correspondence, and other incidentally acquired information) would have been kept in a research chart for the subject. All research materials related to human subjects' participation in this study would have been stored in a secure file cabinet on the premises of the Research and Development site located within the JPMNPI. General access to this information would have been restricted to members of the research team. These records could have also be reviewed by the MMC IRB and Saint Francis University IRB along with other governmental agencies as part of their regulatory duties. For the purpose of this protocol, Protected Health Information (PHI) would not have been collected.

After completing the informed consent process, subjects would have completed screening that satisfied inclusion/exclusion material. During screening, potential subjects would have completed a Needs Assessment Document, to determine if the subject had the required Internet connection available for this protocol at his/her residence. If the subject was unable to complete the survey, a member of the research staff would have assisted him/her. Also during screening, potential subjects would have completed the ALS Functional Rating Scale – Revised (ALSFRS-R) to determine the functional level of the subject. The ALSFRS-R would have been completed by a member of the research staff by interviewing the subject or the subject's caregiver. All qualifying subjects would have completed assessments at baseline, three-months, six-months, nine-months, and one-year. Administration time for all of the assessment is approximately one hour and can be administered either by self-report or verbally by a trained administrator. The clinical assessments include: the Beck Depression Inventory-II (BDI-II), the Beck Hopelessness Scale (BHS), the Profile of Mood States (POMS), and the McGill Quality of Life Questionnaire (QLQ). Subjects would have completed the ALS VTC Evaluation Form at the six month interval only. The plan had been for researchers to utilize previously established CERMUSA and JPMNPI surveys regarding the use of telemedicine equipment, using questions specific to the technologies that would have been tested and evaluated.

Once the inclusion criteria and consents had been completed, baseline data would have been obtained using the above tools. Arrangements would have been made with the subject for delivery of a laptop, webcam, and DynaVox ACC device (the speech generating device to be used for this protocol) to his/her residence. The subject would also have been presented with a Loan Agreement for the equipment provided for review and signature. Education in the usage of the equipment would have been provided by a research staff member. This process would have taken approximately four to eight hours, based upon the subject's previous familiarity with similar equipment. Contact information would have been left with the subject for questions related to the equipment. The plan was for the associate investigator or study coordinator to call the subject weekly for the first eight weeks of the protocol, then monthly for the next four months to determine if there were any questions, problems, or concerns related to the equipment. This would then have been noted in the communication log. Although the subject would have been given contact information and instructed to call in the event that they have a question regarding the equipment/device, no further calls would have been initiated after the six-month interval. The subject and caregiver would have been instructed that any concerns, questions, or issues related to the equipment/device can be communicated by the subject or their caregiver to the research staff at any point in time. When this communication occurred, it would have been noted in a progress note in the subject's chart. The subject would have been required to participate in the meeting by logging into the designated web address (216.27.102.11) already preprogrammed into the laptop computer. The PI, AI, or study coordinator would have noted the subject's attendance on the Attendance Log. It is important to note at this time that although the subject's personal health information was not going to be collected, the moment the subject entered the support group virtually; his or her identity would have been known. A typical support group norm is that of confidentiality. This norm, along with a list of others (Appendix A) would have been provided to the subject prior to entering the support group and reinforced throughout the length of the research protocol by the PI. In the event that the subject did not attend, the PI, AI, or study coordinator would have contacted the subject to determine the reason for not attending. This would then have been recorded in the progress note of the subject's research chart. At the three-month, six-month, nine-month, and twelve-month intervals, psychosocial measures would have been recollected. At six-months, an ALS VTC Evaluation

Form would have been completed to determine the participant's perception of the VTC equipment. The equipment provided to the subject would not have immediately been taken away once the study is completed. Once subjects had been enrolled in the protocol, the VTC/DynaVox equipment would have been provided to them. It would have remained with them until: (a) they were no longer able to physically utilize it and or (b) withdrew from the protocol. In these events, the DynaVox would have been "recycled" to appropriate patients suffering from ALS who could have benefited from its usage. There is no penalty, and subjects would have been permitted to withdraw from the study at any point in time.

Part of the inclusion criteria was that subjects agreed to take part in ten support group meetings. In the event that a subject had not participated for two consecutive meetings, a research assistant would have communicated with the participant to determine the reason for absence from the support group meetings. If the research assistant found that the participant was no longer willing or able to participate in the support group, the investigator would have had the authority to terminate his/her participation.

There is no information that was to be purposefully withheld from subjects prior to and/or during testing. Thus there was no need for debriefing.

The study instruments and rating scales (with explanations) are as follows:

1. **Needs Assessment Document**
   Although each subject would have been given a laptop, DynaVox, and video webcam, it would have been important to assess what type of Internet access was available in the subject's area: Digital Subscriber Line (DSL) or cable modem access.
2. **ALS Functional Rating Scale – Revised (ALSFRS-R)**
   This is a validated version of the ALSFRS that adds an element that measures respiratory dysfunction. This revised scale retains the properties of the original scale and shows strong internal consistency and construct validity (Cedarbaum & Stambler, 1997; Cedarbaum et al., 1999; Miano, Stoddard, Davis, and Bromberg, 2004; Kasarskis et al, 2005).

Baseline / three-month / six-month / nine-month / twelve-month intervals:

1. *Beck Depression Inventory-II* (BDI-II)
   The BDI-II consists of 21 items to assess the intensity of depression in clinical and non-clinical populations. Each item is a list of four statements arranged in increasing severity regarding a particular symptom of depression. The sum of all BDI-II item scores indicates the severity or presence of depression. The BDI-II has been extensively tested for content validity, concurrent validity, and construct validity, with results corresponding to clinician ratings of depression in more than 90% of cases. Factor analysis has also supported the validity of the BDI-II. The BDI-II can be interpreted as one syndrome (depression) composed of three factors: negative attitudes toward self, performance impairment, and somatic disturbance. The BDI-II is recommended in research and clinical settings (Beck, Kovacs, & Weissman, 1975; Beck et al., 1974; Beck & Steer, 1988; Beck, Steer, & Garbin, 1988).
2. *Beck Hopelessness Scale* (BHS)
   The BHS examines an individual's thoughts and beliefs about the future. It consists of 20 true-false items, which measure three major aspects of hopelessness: feelings about the

future, loss of motivation, and expectations. Eleven statements are worded negatively (hopeless), and nine statements are worded positively (hopeful). Examples of the BHS items include: "I look forward to the future with hope and enthusiasm"; "I can't imagine what my life would be like in 10 years"; and "my future seems dark to me." Items are summed for a possible range of 0-20, with high scores indicating greater hopelessness. Scoring is based on the total number of items endorsed. The BHS is recommended for measuring the extent of negative attitudes in clinical and research settings (Beck, Kovacs, & Weissman, 1975; Beck et al., 1974; Beck & Steer, 1988; Beck, Steer, & Garbin, 1988).

3. *Profile of Mood States* (POMS)
   The POMS assessment provides a means of assessing transient, fluctuating mood states. The POMS is an instrument designed for measuring and monitoring treatment changes and the impact of these changes on mood state. The POMS provides information about six factors (tension-anxiety, anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment) which comprise a Total Mood Disturbance score (TMD) (Albrecht & Ewing, 1989).
4. *McGill Quality of Life Questionnaire* (QLQ)
   The McGill QLQ is being utilized due to it being less heavily weighted toward physical functioning and due to its inclusion of an existential domain. It has been validated in patients with cancer and HIV infection and is believed to be a useful tool for assessing QOL in patients with life threatening illnesses (Simmons, Bremer, Robbins, Walsh, & Fischer, 2000; Cohen et al., 1997; Robbins, Simmons, Bremer, & Fischer, 2001).

Six-month interval only:

ALS Equipment/Device Evaluation

Six months after implementation of the protocol, the subject who had been using the technology would have been given an evaluation form to rate the technologies used to connect to the support group. Each question uses a Likert-type scale to rate the general usefulness of the technology.

Surveys, Questionnaires, and Other Data Collection Instruments:

Outcome measures will be obtained using a battery of assessments. All subjects in the treatment group will complete assessments at baseline, three-months, six-months, nine-months, and twelve-months. Administration time for all of the assessments is approximately one to two hours and can be administered either by self-report or verbally by a trained research staff member. All research staff will be instructed on the correct administration of these assessments by the principal investigator. A Needs Assessment Document will be completed at screening to determine if the subject has the appropriate Internet connection available. The ALSFRS-R will be collected at screening to determine the subject's functional ability and appropriateness for enrollment into this research protocol. The ALSFRS-R can be self-reported or completed by a member of the research staff. If the subject is unable to physically complete any questionnaire, evaluation, or assessment, a member of the research team will work with the subject and caregiver and assist them in the completion of the documents to the extent that is needed. Because the focus of this research project is to connect ALS subjects to a support group remotely due to problems related to traveling, in the event that the subject is unable to physically appear in person to complete these assessments and evaluations, the subject will be mailed the documents with a pre-addressed, postage paid return envelope and the research staff will conduct the assessment over the telephone with the subject or the subject's caregiver. The subject and/or subject's caregiver will be instructed to return the document in the postage paid envelope. The following is an outline of the measurements that would have been administered to the subject by interval required:

Screening:
1. Needs Assessment Document
2. ALS Functional Rating Scale – Revised (ALSFRS-R)

Baseline/three-month/six-month/nine-month/twelve-month intervals:
1. Beck Depression Inventory-II (BDI-II)
2. Beck Hopelessness Scale (BHS)
3. Profile of Mood States (POMS)
4. McGill Quality of Life Questionnaire (QOL)

Six-month interval only:
ALS Equipment/Device Evaluation

To minimize risks related to support group participation over VTC:
1. Security issues or breeches such as "hacking" are possible, but also unlikely and may result in loss of confidentiality. This would have been addressed by the security measures that were already in place within the Memorial Medical Center system (i.e., firewalls) and also with the subjects on ISP security measures, all of which made "hacking" a very low possibility.
2. Psychological risks associated with participation in a support group setting would have been minimized as the support group would have been co-facilitated by the PI, Dr. Sharon Plank, and therefore she would have been able to anticipate and minimize these potential risks.

The following is contained within the consent form:
"In the unlikely event you become injured as a result of your participation in this study, Saint Francis University will make every effort to assist you in obtaining medical care. The costs of this medical care will be billed to you or your insurance company. If you want more information about this, please contact the Principal Investigator (Dr. Sharon Plank, at telephone number 814-269-5207)."

Results and Analysis:

The research analysis plan was to have data obtained from this protocol analyzed by an in-house CERMUSA statistician. The statistician would then have evaluated how the support group had affected the psychosocial measurements, looking at the differences in assessments from baseline, three-month, six-month, nine-month, and twelve-month intervals. Researchers would then have evaluated adherence to the monthly support group through the attendance log. The value of the support group and perceptions of participants would have been analyzed through the ALS Equipment/Device Evaluation. Thus allowing the statistician and researchers to evaluate and summarize the results of this test.

Key Research Accomplishments:

The results of this could have been important for the general public as well as military personnel who may experience a variety of medical conditions. The results of this study could have provided information about utilizing AAC over VTC. Additionally, it could have shown the impact of a virtual support group for those who live in rural areas and/or have difficulty leaving the confines of home. The results from this study could have promoted integration of a virtual support group in many populations who may encounter difficulties in traveling to attend support groups.

Reportable Outcomes:

The above-named research study has been terminated by the PI due to the following. The CERMUSA study was to be an extension of a pilot study conducted by the John P. Murtha Neuroscience and Pain Institute (JPMNPI). Delays in obtaining the necessary secondary level IRB approvals for the "pilot study" from the National Naval Medical Center, the Bureau of Medicine and Surgery, and the Army's HSRRB / ORP HRPO hindered protocol execution and prevented the pilot study from moving forward. In addition, the JPMNPI failed to submit the "CERMUSA" protocol to the Memorial Medical Center IRB; which was the IRB of record, thus delaying the process even further. This protocol was initially submitted in November 2006 for pre-read by ORP's second level review but it was never submitted for final IRB approvals. The funding and staff time allotted in the proposal for this study have been re-allocated to other TATRC protocols under both the FY06 program and FY07 proposal.

Conclusions:

Anticipated benefits to the subjects included: (a) an increase in QOL for this population secondary to the participation in the support group and having an increase in social contact related to the technology; (b) additional understanding of the role of technology in chronic illness; (c) an increase in understanding of the role of technology to connect those patients who are in rural settings and unable to connect with medical personnel and others with the disease. These potential benefits considerably outweigh the less than minimal risks associated with participation in the study, thus supporting this research activity as a reasonable endeavor.

The information from this research protocol could have been used and applied not only to ALS patients, but also others with chronic illnesses, to help determine the effectiveness of technology in connecting patients with healthcare professionals and others with the disease. Preliminary research has positively shown the benefit of similar support groups and their impact on improving the QOL of patients suffering from various diseases (Gustafson, et al., 1999). Any information that provides insight on improvement in QOL in patients with ALS and helps to increase the autonomy of this population would be important to the overall wellbeing and treatment of this group.

The benefits of this research outweighed the potential risks. The three risks identified above have been decreased through protective measures developed by the researchers. Additionally, these risks are less than minimal to participants.

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Appendix A – Frank E. Mayak ALS Support Group Meeting (John P. Murtha Neuroscience and Pain Institute)

ALS Support Group Meeting Schedule / ALS Support Group Norms

ALS Support Group Meetings
Second Tuesday of month from 4:00 – 5:30 p.m.

2006	2007
January 10	January 9
February 14	February 13
March 14	March 13
April 11	April 10
May 9	May 8
June 13	June 12
July 11	July 10
August 8	August 14
September 12	September 11
October 10	October 9
November 14	November 13
December 12	December 11

Confidentiality: This refers to the concept of privacy within the group, in that what individual participants say in the group to each other is not shared with anyone outside the group.

Attendance: All groups members should make an effort to attend the group in a timely fashion, and if late attending (which may happen to anyone of us), minimizing distractions upon entering the group. In addition, if unable to attend the next group, notification of this is often appreciated.

Interruption or cross talk: This refers to the dynamic in which group members may not allow a person to finish their statement before replying, or when sub sets of conversation are occurring within the group.

Advice giving: This is a natural inclination in group, but in many instances the person receiving the advice has received multiple advice from members of their own family or friends, and it can often be experienced as intrusive or overwhelming by a group member. Advice giving is distinct from sharing of information or personal experiences, which are often viewed as helpful by group members.

Appendix B – Beck Depression Inventory II – Page 1 of 2

BDI-II

Date:

Name: ______ Marital Status: ______ Age: ______ Sex: ______

Occupation: ______ Education: ______

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today.** Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment Feelings

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying

0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

______ Subtotal Page 1

Continued on Back

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Appendix B – Beck Depression Inventory II – Page 2 of 2

Appendix B Page I I of II Beck Depression Inventory II

11. Agitation

0 I am no more restless or wound up than usual.
1 I feel more restless or wound up than usual.
2 I am so restless or agitated that it's hard to stay still.
3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0 I have not lost interest in other people or activities.
1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It's hard to get interested in anything.

13. Indecisiveness

0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14. Worthlessness

0 I do not feel I am worthless.
1 I don't consider myself as worthwhile and useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15. Loss of Energy

0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don't have enough energy to do very much.
3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day.
3b I wake up 1–2 hours early and can't get back to sleep.

17. Irritability

0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18. Changes in Appetite

0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than usual.
3a I have no appetite at all.
3b I crave food all the time.

19. Concentration Difficulty

0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 It's hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

20. Tiredness or Fatigue

0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of the things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

11 12 ABCDE

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Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Utilizing "Off-Center Robotic Neuro-Rehabilitation to Assess Kinematic Relearning in Upper Extremity Deficits after Stroke

Protocol No.: 05-TATTR214-05

Date: March 12, 2008

Protocol Title: Utilizing "Off-Center" Robotic Neuro-Rehabilitation to Assess Kinematic Relearning in Upper Extremity Deficits after Stroke

Principal Investigator: William DeMayo MD, John P. Murtha Neuroscience and Pain Institute (JPMNPI); ***CERMUSA Collaborator:*** Brenda Guzic, RN, BSW, MA

Protocol Executive Summary:

Saint Francis University's CERMUSA, Georgetown University's Imaging Science and Information System (ISIS) Center, and the John P. Murtha Neuroscience and Pain Institute (JPMNPI) have collaborated on a study to examine the feasibility and relevance of using robotics and computing technologies to deliver outpatient rehabilitative therapy. The project is utilizing an electrically driven robotic device called the "InMotion2" (IM2); which is listed with the Federal Drug Administration (FDA) both as an evaluation device (890.1925) and as a therapy device (890.5380). This research project is exploring the viability of using the IM2 Shoulder-Elbow Robot to deliver therapy to patients living in remote locations by incorporating virtual reality with haptic feedback.

The objectives are: to evaluate sensori-motor recovery using a robotic training device in an "off-center position" (away from the midline of the body) in subjects with at least one year history of hemiparesis due to stroke, to demonstrate a relationship between a sensori-motor evaluation with a robotic unit and conventional neuromuscular assessment, provide an alternative method of rehabilitation to facilitate motor relearning outside of the "initial recovery period", and fill the void in rehabilitative healthcare resources with the use of innovative technology.

Introduction:

Stroke is the third leading cause of death in the United States and the number one cause of disability; and as the population continues to age, this will continue to be the case. It is important to note that 90% of stroke victims are older than 65 and that presently there are 36.3 million American citizens 65 years of age or older; accounting for 12 percent of the total population. Of that number, 9.7 million are military veterans (U.S. Census Bureau, The 2007 statistical abstract).

The following facts from two major stroke organizations make the impact of stroke quite clear:

According to the American Stroke Association (2006):

- Stroke is the third leading cause of death in the United States and is expected to consume 62.5 billion healthcare dollars in 2007 in direct and indirect costs
- Statistics indicate that nearly 750,000 Americans suffer from new or recurrent strokes each year, and approximately 5.2 million stroke survivors are alive today
- The estimated number of non-institutionalized stroke survivors increased from 1.5 million in the early 1970's to 2.4 million in the early 1990's
- Stroke rehabilitation strives to assist these stroke survivors to reach the highest level of independence and productivity possible

According to the National Stroke Association (2006):

- Approximately 65% of stroke victims experience mild, moderate, or severe impairments requiring special care
- 10% of the victims experience a near complete recovery
- The mortality rate for stroke victims still remains high at 25%
- Although many functional abilities may be restored soon after a stroke, recovery is an *ongoing process.*

In the Department of Veterans Affairs (VA), stroke related diseases consume at least $1 billion annually, or 5% of health care resources, with approximately 15,000 new stroke patients seen each year. A 1999 study suggested a much higher incidence of stroke than previously reported, with 259 new strokes per 100,000 population. The increasing number of older adults and the emergence of new therapies for acute stroke suggest that the number of survivors with significant residual physical, cognitive, and psychological disabilities will continue to increase, with more survivors living with the aftermath of stroke (U.S. Department of Veterans Affairs, 2007).

Stroke survivors in remote or medically underserved areas of the state are faced with a variety of obstacles in accessing care. In addition, rehabilitation facilities are forced to seek alternative approaches to patient care as a result of the Prospective Payment System (PPS), a reimbursement structure enacted in January 2002. Inpatient rehabilitation options are severely restricted and, when available, lengths of stay are significantly shorter than in the past. Consequently, stroke rehabilitation goals are shifted to outpatient rehabilitation centers or the home setting. This imposes an even greater challenge in rural medically underserved areas, which have fewer healthcare workers to serve patients with a disability (Scheideman-Miller, Clark, Moorad, Post, Hodge, & Smeltzer, 2002). Therefore, alternative healthcare delivery models utilizing technology may fill the void in rehabilitative healthcare resources and community needs. These innovative delivery methods must explore technology options, clinical outcomes, patient acceptance/fear of treatment, and reimbursement issues (Scheideman-Miller et al., 2002).

One example of such a program is in place at The Shephard Rehabilitation Center in Atlanta, Georgia. This state-of-the-art center uses telemedicine connections with outpatients to monitor the healing of pressure ulcers, to assist newly injured clients with psychological adjustments, to evaluate and recommend changes to the home, to identify needed changes to equipment, and to evaluate individuals with acquired brain injuries (Advance for Occupational Therapy Practitioners, 2002). It has proven that innovative healthcare delivery models utilizing technology can help to fill the void in rehabilitative healthcare resources.

Despite having several stroke centers located in southwestern Pennsylvania, many patients live in exceptionally remote areas of the state (Pennsylvania Department of Health, 2004 and Pennsylvania State Data Center, 2003). This creates a challenge for the non-institutionalized stroke survivors; they often cannot obtain essential outpatient physical therapy because of barriers such as transportation. Education and research are two very important ways to help improve the morbidity and mortality rates associated with strokes.

The modern approach to the treatment of stroke has appropriately focused on prevention and acute management. However, prevention does not work for all (American Heart Association, 2004), and new pharmacology for acute management has practical limitations, so that there has been a revival in developing new treatment strategies for post-stroke recovery. The theme of current research into recovery from brain injury, that activity-dependent plasticity underlies neuro-recovery, motivates the attempt to alter stroke outcome by properly targeted sensori-motor activity controlled by novel robotics. The IM2 robotic device combines visual display with haptic (force) technology. It is capable of assessing the physical condition of the patient via bilateral manipulation and force feedback over the Internet. It also has the capability of performing cooperative physical therapy with the patient over the Internet in a virtual environment.

Methods:

An IM2 Robot user group was convened to explore potential research opportunities utilizing the IM2 Robot. The IM2 Robot user group consisted of members from the following organizations:

- Georgetown University's Imaging Science and Information System (ISIS) Center
- John P. Murtha Neuroscience and Pain Institute (JPMNPI)
- Massachusetts Institute of Technology (MIT)
- National Telerehabilitation Service System (NTSS)
- Interactive Motion Technologies
- Center for Applied Biomechanics and Rehabilitation Research, National Rehabilitation Hospital

Several meetings were held and the following areas were addressed:

- Therapy using haptic feedback
- Cooperative rehabilitation using a Shared Virtual Environment
- Past successes of the IM2 Robot in the midline position
- Potential benefits of "off-center" utilization
- Demonstration of equipment
- Training of the JPMNPI and NTSS staff

Based upon the information shared among members of the group, the level of professional expertise of the group members, past successes of the IM2 Robot, and an identified need to provide an alternative treatment modality for stroke survivors, the decision was made to proceed. This is a pilot, outcome-based study involving thirty-six subjects previously diagnosed with a unilateral cerebral or basal ganglia stroke verified by Computed Tomography (CT) or Magnetic Resonance Imaging (MRI). The subjects will act as their own control (six week waiting period vs. six week intervention).

Initial recruitment has focused on stroke survivors more than one year post discharge from Memorial Medical Center (MMC), located in Johnstown, Pennsylvania. Candidates are mailed an informational flier by the Crichton Rehabilitation Center located in Johnstown, PA. However, this method of recruitment has failed to recruit the needed thirty-six participants and recruitment efforts have been expanded to include physician referrals and direct recruiting via advertisements to the general population. Patients who express initial interest are mailed a letter inviting them to an information session to explain the scope of the study. Potential participants may indicate at that time their willingness to participate in the study (the choice is always theirs). Eligible individuals are scheduled for clinical evaluation with the Principal Investigator (PI) to confirm that remaining inclusion/exclusion criteria are satisfied.

Eligible and willing individuals have the opportunity to review the informed consent with the study coordinator. They are invited to meet with the study coordinator to review the informed consent in detail. The participant is encouraged to ask questions and his/her understanding is documented on a Statement of Understanding. If they decide to proceed and have demonstrated an understanding, they will be asked to sign the informed consent, medical records release form, and the Health Insurance Portability and Protection Act (HIPPA) release form in the presence of the study coordinator and a witness. This informed consent process occurs prior to any participation in the protocol.

In this study of robotic sensitivity for stroke survivors, we are interested in seven continuous measures:

- Mental State
- Depression
- Pain and Strength
- Motor Status
- Motor Power
- Spasticity
- Shoulder Stability

This study will utilize 4-point, 6-point, and 10-point measurement scales. A review of previous studies using these scales shows a trend for a standard deviation of 1.5 units. Therefore, to obtain a power of 0.80 and a probability of type II error of 0.20 for these two independent groups, the following formula is used:

Plan:

Number of Subjects to be studied: **36**

- Rational for sample size

$$\mathbf{n} = \frac{(\mathbf{SD^2 + SD^2}) \mathbf{\ x\ } (\mathbf{Z_{1\text{-}alpha/2} + Z_{1\text{-}beta}})^2}{\mathbf{D^2}}$$

Where:

n = sample size
SD = standard deviation = 1.5
Z = standard normal deviation
Alpha = probability of Type I error (0.05)
1-alpha/2 = 1-0.05/2 = 1-0.025 = .975
z = 1.96 from table
1-beta = 1-0.02 = 0.80
z = 0.84 from table

Beta = probability of Type II error (0.05-0.20)
D = clinically relevant difference = 1

Substituting:

$$n = \frac{(1.5^2 + 1.5^2) \times (1.96 + 0.84)^2}{1^2} = 35.3$$

Therefore, in order to achieve 80% power for detecting one unit difference in the scores, which has a standard deviation of 1.5, it will be necessary to sample 36 patients, serving as self-controls.

Robotic Data Collection and Exercise:

- Robotic Evaluation Protocols will be performed in a midline as well as "off-center" position (offset of 20 cm toward the affected side)
- Robotic Exercise protocols will be performed using computer protocols with an offset of 20 cm toward the affected side
- Subjects will need to complete 15 of the 18 sessions as well as the evaluations to remain in the study. Subjects will need to complete 80% of the repetitions (2048) in order for the session to be included

Other Data Collection:

- Outcome measures will be obtained using a battery of assessments as well as the Robo-kinematic Assessment. Assessments will be conducted at the following intervals:
  - Entrance into the study
  - At six weeks (prior to intervention)
  - At twelve weeks (the completion of the intervention)
  - At six months (three month follow up post intervention)
  - At nine months (six month follow up post intervention)
- The assessment battery outlined below will be performed concurrently with all robotic data collection in order to allow the objective improvements noted by the robot to be compared to changes on previously standardized tests and to allow assessment of other factors such as depression or spasticity which might effect testing.
- Assessment Battery*:
  - Mini Mental State
  - Beck Depression Inventory
  - Visual Analog Scale for Pain and Strength
  - Motor Status Score
  - Motor Power Score
  - Modified Ashworth Spasticity Assessment
  - Shoulder Stability Testing
  -

***These assessments are to confirm continued eligibility.**

This robotic device is capable of exerting approximately five pounds of force at the handle in each direction. Since it can attain high speeds if released, a number of software safety systems are in place to prevent uncontrolled motion or allowing forces to exceed hardware limits. In addition, two independent emergency stops are within easy reach of the experimenter and the subject and "bumpers" are in place to keep the handle of the robot within the confines of the work area. To minimize any potential risk of injury, multiple levels of protection have been built into the machine. In the event of a malfunction, the servo-amplifiers are disabled within a few milliseconds, removing power from the motors. Machine malfunctions are detected in several ways. Excessive speed, acceleration, or force exerted are detected by the controlling software and result in disabling the system. An independent electronic circuit monitors the motion of the robot, the availability of electrical power, the health status signal from the servo-amplifiers, the health status signal from the encoders, and the status of two human-operated "kill-switches". Software failure, motion beyond a specified range, loss of electrical power, or activation of the switches all shut down the robot. During all robotic interventions, a trained member of the research team will be present. It is important to note that an earlier model of the IM2 Robot has been used in clinical trials at the Baltimore VA Hospital for two years without incident, and current models incorporate additional safety features. (MacClellan LR., Bradham DD., et al. 2005).

Results and Analysis:

It has been the goal of this project to recruit, evaluate, and enroll 36 study participants. From the project inception, 7 participants have been enrolled. Of the 7 one had to withdraw because he could not demonstrate functional stability in the pre-intervention assessment phase, 4 are considered "active" such that they have successfully completed the pre-intervention evaluation phase and the 6-week robotic intervention and are now enrolled in the follow-up phase, and the remaining 2 are in the pre-intervention assessment phase (enrolled but not yet active in the intervention). Twelve individuals were screened/evaluated and found ineligible to proceed. Three participants have undergone their 6-month follow-up evaluations and 1 participant has undergone a 3 month follow-up evaluation. A comparison of data was completed for one research subject in the pre-intervention phase. Subject did not demonstrate functional stability of the involved arm on the robotic assessment. Following discussion with the Principal Investigator, patient was re-assessed, met criteria, and was enrolled in the study.

Baseline, stability, and post-intervention data will be validated using a pair-wise comparison, utilizing the 2-tail t-test. Follow-up data and Robotic Assessments will be compared utilizing the Analysis of Variance (ANOVA) method. The ANOVA method will allow for comparison of Robotic and Manual assessments. Formal analysis of the data gathered to date has not yet been done.

Key Research Accomplishments:

Institutional Review Board (IRB) issues and satisfaction of requirements of our military oversight partners delayed the initiation of the study. On November 30, 2006, an approval memo was received from the Human Research Protection Office (HRPO), Office of Research Protection (ORP), U.S. Army Medical Research and Material Command (USAMRMC) which indicated that the subject protocol was reviewed and found to comply with applicable Federal, Department of Defense (DOD), U.S. Army, and USAMRMC human protection regulations. In addition, approval was obtained from the MMC IRB and the United States Army Telemedicine and Advanced Technology Research Center (TATRC). However, the inclusion/exclusion criterion was found to be too restrictive and put limitations on the recruitment process.

Appropriate changes were made to the criterion and the changes were submitted to the MMC IRB. Final approval for these changes was not obtained until July, 2007. With these approvals in place, the study has now moved forward.

Reportable Outcomes:

In the first phase of the protocol the IM2 robot is being utilized in a conventional therapeutic mode that incorporates a situation that has not yet been studied. In an effort to increase neuro-kinematic function in stroke survivors, the first protocol will be completed with subjects performing an evaluation and treatment in an "off-center" position. By using this conventional operation approach the JPMNPI and CERMUSA staffs have had the opportunity to become familiar with the robot. Data from this pilot study can then be used as the basis for future protocols to include, but not be limited to, investigating the remote operation capabilities of the IM2 Robot.

The literature reviews indicate that most conventional research with the robotic unit has been completed with the robotic arm located at the midline of the body. Our hypothesis for our first protocol is that the use of "off center" robotic exercise in stroke survivors will increase neuro-kinematic function in individuals with upper extremity impairments. The "off center" location for the robotic exercise will be located 20 centimeters away from the midline of the body towards the affected side of the client.

This protocol could have a profound effect in treating individuals recovering from neurological conditions such as stroke, Parkinson's disease, spinal cord injury, motor impairments, traumatic brain injury, and cognitive difficulties. Two studies involving the use of the IM2 robotic unit in the midline position have demonstrated statistically significant increases in motor power and motor status scoring up to six months following robotic interventions (Reinkensmeyer, Pang, Nessler, & Painter, 2002).

This study received an American Institute of Biological Scientists (IBS) review in July 2005 (#05350004). The review noted that the hypothesis is clear and concise, and the objectives further clarify the value of the study. This is expected to yield publishable information related to a new method of stroke patient rehabilitation.

Many research facilities are investigating the use of robotics to provide rehabilitative treatment to disabled individuals:

- Stanford University's Dexterous Manipulation Laboratory is utilizing a dexterous robotic hand to enable the user to interact with the environment from a remote location (Stanford University Mechanical Engineering Research Laboratory, 2002)
- Rutgers University is investigating the use of a virtual-reality haptic (force) interface utilizing a robotic ankle that allows patients to interact with virtual environments as they exercise (Rutgers University, 2001) and
- The Jerusalem TeleRehabilitation System has developed a system that operates in a stand alone mode or a cooperative mode between patient and therapist connected via the Internet (Sugarman, Dayan, Weisel-Eichler, Tiran, 2006)

Studies involving the use of the IM2 robotic unit have demonstrated statistically significant increases in motor power and motor status scoring up to six months following robotic interventions (Fasoli, Krebs, Stein, Frontera, & Hogan, 2003 and Volpe, Krebs, & Hogan, 2003). One such study was conducted by the Massachusetts Institute of Technology utilizing twenty persons diagnosed with a single, unilateral stroke within the past one to 5 years, with persistent hemiparesis. Evaluations by a single blinded therapist revealed statistically significant gains from admission to discharge for all participants that were able to complete the study. To date, studies have been performed in the midline of the body. Observations indicate performances of the protocols are more difficult from an "off-set" (away from the center of the body toward the affected side) position and researchers have theorized the off-set position may result in even greater motor sensory recovery. The primary goal of our study is limited to demonstrating the effectiveness of the off-center position; however, future studies may compare off-center position results with midline position results.

Future research opportunities may also include evaluation and treatment from remote settings. The IM2 has demonstrated the potential to be used over the Internet. Its novel design allows for complex movements of the upper extremity as well as remote haptic feedback. In a web-based study of java applications for robotic control in a home setting, it was suggested that robotic intervention also had a direct impact on depression and independence in stroke survivors (Reinkensmeyer, Pang, Nessler, & Painter, 2002). This study was limited by its use of "off-the-shelf" equipment which is restricted to utilizing motion at the wrist with a joystick or mouse. We feel the use of the IM2 via the Internet should produce similar results.

Conclusions:

The technology is currently in place to use the IM2 remotely – establishing the possible future treatment of stroke patients in the home or in a rural clinic far from a stroke professional (Olsson, Carignan, & Tang, 2004).

Future efforts could include, but not be limited to, the following:

- Comparing "off-center" results with midline results
- Evaluation and treatment of patients from remote settings (home or rural clinic)
- Use over the Internet
- Treatment of other neurological disorders such as traumatic brain injury, Parkinson's disease, and spinal cord injury

We feel that telerobotic technologies will enhance and expedite physical and mental recovery of individuals with disabilities resulting from stroke. This product has the potential of expanding its scope to include other neurological disorders and may prove to be a viable adjunct to treatment, or a treatment alternative, in areas with limited resources and/or increased community needs. However, CERMUSA's participation and collaboration in the above named protocol has ended as of November 30, 2007 due to the following:

- Delays in obtaining Institutional Review Board (IRB) approval from the MMC IRB (the IRB of record) delayed the initiation of the project
- Upon initiation of the protocol the Inclusion/Exclusion criteria was found to be too restrictive and placed undo limitations on the recruitment process; thus preventing the project from moving forward

- Protocol changes made after the initial IRB approval was obtained required further IRB review. Final approval of these changes was not obtained until July 31, 2007 (10 months into the study); hence delaying the process even further

This was to be a multi-phase project and the partners agreed that in Phase One the IM2 robot would be utilized in a conventional operation mode. The goal was to allow the CERMUSA and JPMNPI staffs to become familiar with the robot. It was also believed that IRB approval would be easier to obtain utilizing a conventional treatment. Data collected from this "pilot study" could then be used as the basis for future protocols to include, but not be limited to, investigating the remote operation capabilities of the InMotion2 (IM2) robot.

CERMUSA's role was to provide "technical support" and evaluate the "telerehabilitation outcomes". However, no telerehabilitation component has been implemented and there is no "estimated date" when this will occur. In addition, there have been no technical issues for CERMUSA to deal with and all software or operational issues have been handled between the JPMNPI and ISIS.

An amendment was submitted by the JPMNPI to the MMC IRB to formally end CERMUSA's participation in this project. Approval documentation from this IRB was forwarded to Mr. Brad Sullivan and Mr. Edward Kensinger and the Office for Research Protection (ORP), Human Research Protections Office (HRPO).

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Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Developing the Virtual Classroom for Distance Education Training

Protocol No.: 05-TATDL201-05

Date: March 12, 2008

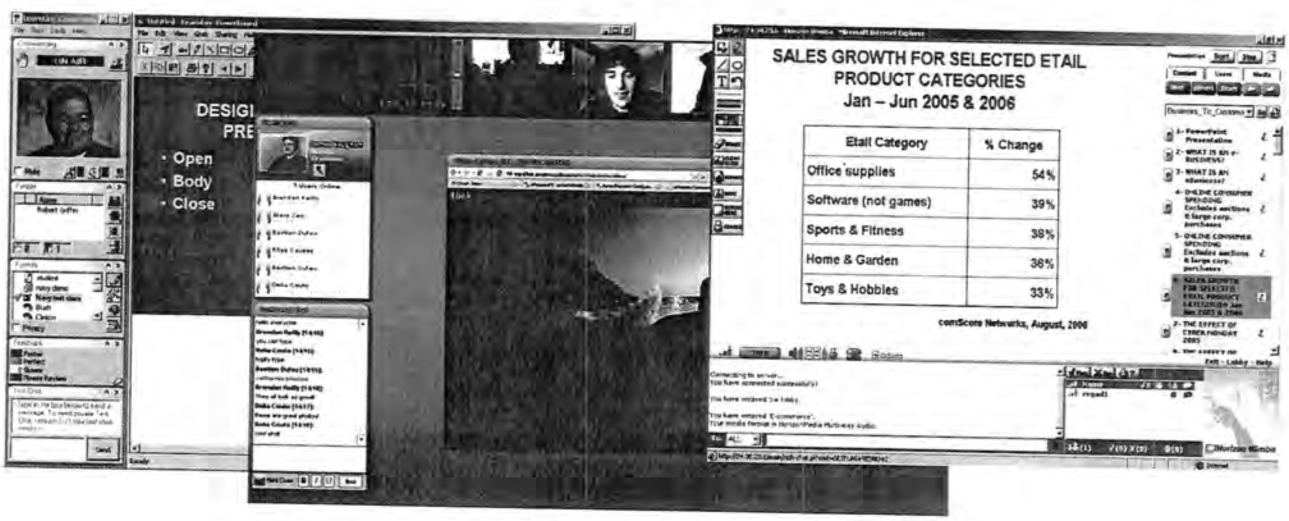
Protocol Title: Developing the Virtual Classroom for Distance Education Training

Principal Investigator: Dana Friedman

Protocol Executive Summary:

This year CERMUSA staff completed the final two phases of the four-phase study. During the third phase, a live course was compared with the online course, and the final phase was dedicated to confirm our findings from the previous phase which compared three different Virtual Classroom Software packages (iLinc, Wimba, and ePresence).

Screen shot iLinc Screenshot Wimba



Screenshot ePrecence

For the fourth phase, the software developed by Microsoft was replaced with an open source software called “ePresence”. The results of the virtual classroom study were presented at two conferences (2006 IVLA meeting, Orlando, FL (2006); and the Educause meeting, Baltimore, MD (2007)). The overall results of this study were presented at the Wimba Conference, Orlando, FL (March 2008).

Introduction:

The virtual classroom software is software that simulates a live classroom environment. It allows a teacher and students to interact with each other in real time: they can share applications, documents, whiteboards, and presentations. The salient feature of this software is that it only requiresa computer with speakers and microphone and a high speed Internet connection.

Our results show that this software will allow the military personnel the opportunity to continue their education by attending classes while deployed. If the student is unable to participate in any interactive sessions, those sessions can be archived and accessed reviewed later to fulfill the educational need.

Methods:

Phase 3: Comparison of Live and Online sessions (16 participants: 9 live, 7 online)

- iLinc was used during this phase of the study because it was ranked highest in Phase 2 of the protocol.
- Participants were given a choice of attending the classes "live" or in an "online group".
- Participants were given a pretest and a post-test. The results of these tests were analyzed to determine the differences between the live and online group.
- The group of students that volunteered for the online sessions was also asked to evaluate the software.

Phase 4: Repeat of Phase 2 (6 participants)

- The course was divided into three sections. For each section, participants completed a pretest and post-test to determine if there was a gain of knowledge.
- The participants also completed a survey to evaluate softwares.

Results and Analysis:

Results for each of the last two phases are attached. A Saint Francis University Statistician analyzed these data.

Key Research Accomplishments:

Our studies has repeatedly shown that these softwares allow students to gain knowledge. Also, we found that there is no difference in learning when accomplished live or online. The significance of our finding is that anyone with a computer with Internet access can attend a course that is equal in quality to a real classroom experience. This will help the military personnel to continue their education while deployed.

Reportable Outcomes:

A Virtual Classroom Training center was developed to provide instructors a venue to teach. At the center one can see both the teacher's view and student's view of the virtual classroom software. It also offers a training facility that allows instructors and teachers to become familiar with the software they use.

This research has allowed us to develop a checklist of requirements that are needed in virtual classroom software.

This study has allowed us to become familiar and gain expertise with the two software packages that we have found to be the best: Wimba and iLinc.

The results of this study were presented at Wimba Connect '08 Conference in Orlando, Florida.

Conclusions:

Wimba and iLinc are two softwares that are suitable alternatives to the live classroom. Those who participated in the study showed that there was virtually no difference between the knowledge gain regardless of the mode of attendance: live or online. Both the softwares were deemed to be excellent, although Wimba was favored slightly over iLinc. This is in stark contrast with our previous findings (Phase 2) where iLinc was favored. We feel that newer version of Wimba may have something to do with that tilt. Needless to say, end user expectations will continually improve these softwares and thus, the end user will always be the winner.

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Appendices:

Appendix 1 – Results from Phase 3
Appendix 2 – Results from Phase 4

Saint Francis University

Masters of Business Administration

MBA504
Managerial Communications

VCS Pilot Analysis

Summer 2007

Created: June 26, 2007
Last Revised: July 8, 2007

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MBA504 VCS Analysis

Introduction

MBA504 is a core course in the Saint Francis University MBA program. Eighteen students enrolled in the summer 2007 offering of this course. Prior to the beginning of the course, students were asked to self-select into one of two groups. The first group, the *classroom group*, received all lectures and course related material in a traditional face-to-face classroom setting. The second group, the *virtual group*, received the same educational intervention as the classroom group but all classroom lectures were done at a distance utilizing the iLink Virtual Classroom Software (VCS) tool. Both groups of students were taught by the same instructor, received the same material, and were evaluated in the same manner. In conducting this study, the researchers hope to provide insight into several research questions related to the use of VCS tools to facilitate a masters level higher education course.

Question 1 Analysis

The first question posed was: Did the students in this case study attain different levels of achievement on course-related material based on the method of course delivery?

In an effort to answer this question, the researchers utilized a pretest/posttest methodology. To establish a baseline of each participant's knowledge of the subject matter before the educational intervention, a pretest was administered to all students (n=18). The scores out of 50 possible points were recorded and a percentage score was calculated. After several weeks of an educational intervention delivered in a face-to-face fashion for the classroom group (n =11) and using iLinc software for the virtual group (n=7), a posttest was completed by each student. The scores out of 60 possible points were recorded and a percentage score was calculated. For each student, a difference score was calculated by subtracting the pretest score from the posttest score. Both the pretest and posttest questions were generated randomly from a bank of XXX course-related test questions. The analysis below shows the mean for the pretest, posttest, and difference scores for the classroom group, the virtual group, and the total group. (Note: Two of the students in the classroom group did not complete the pretest and their results have been excluded from this particular analysis.)

	N	Mean of Pretest % Score	Mean of Posttest % Score	Mean of Difference
Classroom Group	9	51.56%	87.41%	35.85%
Virtual Group	7	51.43%	81.91%	30.48%
Total	16	51.50%	85.00%	33.50%

The results of the analysis show that students in the classroom group realized an average increase in achievement of 35.85% while students in the virtual group realized an average increase of 30.48%. Further, a two sample t-test assuming equal variances was conducted to determine if significant difference existed between the difference scores of the two groups. This test resulted in a p-value of 0.493 indicating that there was not enough evidence to suggest significant differences between the two groups. A subsequent power analysis (assuming an alpha = 0.05) that was conducted revealed only a 40.5% probability of detecting a difference as small as 5% but, a 92.9% probability of detecting a difference of 10%.

Question 2 Analysis

The second question posed was: Did any significant differences exist in the pre-test scores between the students who opted into each group?

Prior to choosing a course delivery format, each student was administered a pretest to gauge knowledge of course related concepts. The scores out of 50 possible points were recorded and a percentage score was calculated. The analysis below shows mean scores for the pretest for the classroom group, the virtual group, and the total group. (Note: Two of the classroom group students did not complete the pretest and their results have been excluded from the particular analysis.)

	N	Mean of Pretest % Score	SE Mean	Median
Classroom Group	9	51.56%	3.62	52.00
Virtual Group	7	51.43%	4.74	48.00
Total	16	51.50%	2.80	52.00

The scores of the two groups on the pretest were remarkably similar. Further, a two sample t-test assuming equal variances was conducted to determine if significant difference existed between the difference scores of the two groups. This test resulted in a p-value of 0.983 indicating that there was not enough evidence to suggest significant differences between the two groups.

Question 3 Analysis

The third question posed was: Did any significant differences exist between the classroom group and the virtual group in the grade received on the executive summary assignment?

The analysis below shows mean scores for the executive summary assignment for the classroom group, the virtual group, and the total group.

	N	Mean of Pretest % Score	SE Mean	Median
Classroom Group	11	91.55%	2.23	95.00
Virtual Group	7	97.00%	0.951	98.00
Total	18	93.67%	1.52	96.00

As the average score of the virtual group was higher than the classroom group, a two sample t-test assuming equal variances was conducted to determine if statistical evidence existed to indicate that the virtual classroom group scored higher on average. The test resulted in a p-value of 0.040 indicating that there was enough evidence to suggest the virtual group scored higher on the executive summary.

Question 4 Analysis

The fourth question posed was: Did any significant differences exist between the classroom group and the virtual group in the grade received on the individual presentation assignment?

The analysis below shows mean scores for the individual presentation assignment for the classroom group, the virtual group, and the total group.

	N	**Mean of Pretest % Score**	**SE Mean**	**Median**
Classroom Group	11	92.82%	1.78	94.00
Virtual Group	7	93.29%	1.43	92.00
Total	18	93.00%	1.19	94.00

As the average score of the virtual group was higher than the classroom group, a two sample t-test assuming equal variances was conducted to determine if statistical evidence existed to indicate that the virtual classroom scored higher. The test resulted in a p-value of 0.427 indicating that there was not enough evidence to suggest that the virtual group scored higher on the individual presentation assignment.

Question 5 Analysis

The fifth question posed was: Did any significant differences exist between the classroom group and the virtual group in the grade received on the group presentation assignment?

The group presentation assignment consisted of both a written portion and a power point presentation. Scores were assigned separately for each of these components. The analysis below shows mean scores for the group written assignment for the classroom group, the virtual group, and the total group.

	N	Mean of Pretest % Score	SE Mean	Median
Classroom Group	11	92.455%	0.157	92.00
Virtual Group	7	95.857%	0.404	95.00
Total	18	93.778%	0.440	93.00

As the average score of the virtual group was higher than the classroom group, a two sample t-test assuming equal variances was conducted to determine if statistical evidence existed to indicate that the virtual classroom scored higher. The test resulted in a p-value < 0.01 indicating that there was enough evidence to suggest the virtual group scored higher on the group written assignment.

The analysis below shows mean scores for the group power point assignment for the classroom group, the virtual group, and the total group.

	N	Mean of Pretest % Score	SE Mean	Median
Classroom Group	11	92.364%	0.472	91.00
Virtual Group	7	94.429%	0.202	94.00
Total	18	93.167%	0.381	94.00

As the average score of the virtual group was higher than the classroom group, a two sample t-test assuming equal variances was conducted to determine if statistical evidence existed to indicate that the virtual classroom scored higher. The test resulted in a p-value < 0.01 indicating that there was enough evidence to suggest the virtual group scored higher on the group power point assignment.

MBA504 Course Survey

After completion of the course, a survey was administered to all study participants. The purpose of the survey was twofold. First, the survey gathered demographic data to ascertain if any relationships existed between these items and course delivery selection. Second, the survey gathered data regarding the participant's perception of the virtual classroom software. The analysis of this survey follows:

Age Analysis

The ages of the students in both the classroom group and virtual group were categorized in five year intervals. Further, each interval was assigned a numeric value. These numeric values are shown in parentheses. A mean was calculated for each group using this numeric value. The classroom group had a mean of 2.4 while the virtual group had a mean of 3.0. Showing that the virtual group was slight older than the classroom group however, there does not appear to be any significant relationship between the participants age and the method selected for course delivery.

Age Range	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
20 to 24 years (1)	3	30%	0	0%
25 to 29 years (2)	4	40%	3	42.86%
30 to 34 years (3)	1	10%	2	28.57%
35 to 39 years (4)	1	10%	1	14.29%
40 to 44 years (5)	0	0%	1	14.29%
45 to 49 years (6)	1	10%	0	0%
50 years and over (7)	0	0%	0	0%
Total	10	100%	7	100%

Rationale for Course Delivery Selection

Each group was asked to provide a rationale for selecting their course delivery selection. This was an open-ended narrative question. The results are as follows:

Classroom Group

I chose to take the class in the classroom because I felt it would be more suiting to my schedule.

I didn't have the hardware necessary to enroll in the virtual classroom.

I just prefer the classroom environement. My life is dynamic and filled with work and family obligations. I enjoy and need the time and space to learn around other business/education students. Compueter technology is in everything I do in my employment and other fields of training. It's refreshing for me to attend class in person with professor.

I'm a GA on campus and I work the days I have class so it just made sense to stay once I was here.

I like the classroom atmosphere.

no need for online

I live close to campus

I had another class on Mon./Wed. nights or I may have considered the virtual option.

Limited computer skills

to ensure that I would pay attention to the information at hand.

Virtual Group

Initially, I chose the virtual option as a conveinence supplemental to my busy career schedule. Additionally, I had no prior experience with virtual learning and technologies.

The main reason that I selected the virtual option was due to scheduling. The virtual option was offered on Mondays and Wednesdays. The classroom option was Tuesdays and Thursdays. Mondays and Wednesdays were a better fit in my schedule.

I selected the virtual option because the Classroom option conflicted with my summer league basketball games.

I just want to take the course from the comfort of my home. I didn't want to put the long days in on campus

it was a good way to save money on gas and with current family situation it was convenient

Working full time, the virtual options provides additional flexibility and saves on the drive time to and from a face to face classroom session.

A new learning experience...also to save gas and travel time!

Prior Online Class Experiences

All participants in the virtual classroom indicated some type of prior online class experience while only 40% of the classroom group had prior online experience. Stated another way, of the 11 students that reported prior online experience 7 (63.6%) selected the virtual delivery method. This would seem to indicate that prior online experience correlated positively to the selection of a virtual deliver method.

Prior Experience	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
I have not attended a distance class	4	40%	4	57.14%
Synchronous	1	10%	2	28.57%
Asynchronous	2	20%	1	14.29%
Mixed	1	10%	0	0%
I don't know	2	20%	0	0%
Total	10	100%	7	100%

Same Decision?

After the completion of the course, students were asked if they would have made the same choice about their course delivery method. All (100%) of the virtual group said that they would have made the choice however the classroom group showed some regret with 20% reporting that they were not pleased with their choice.

Same Decision?	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Yes	8	80%	7	100%
No	2	20%	0	0%
Total	10	100%	7	100%

Computer Skills

Interestingly, there was significant difference reported between the two groups. All but one (90%) of the classroom group reported at least average proficiency with computers with one (10%) reporting far below average proficiency. As well, all but one (85.71%) of the virtual group reported at least average proficiency with computers. This would seem to indicated that there was no significant relationship between level of computer skills and course delivery selection.

Computer Skills	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Outstanding	2	20%	1	14.29%
Very Good	4	40%	4	57.14%
Average	3	30%	1	14.29%
Below Average	0	0%	1	14.29%
Far Below Average	1	10%	0	0%
Total	10	100%	7	100%

Number of Computers in Household

The number of computers in household was similar for both the classroom group and the virtual group.

Number of Computers	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
0	0	0%	0	0%
1	3	30%	2	28.57%
2	6	60%	4	57.14%
3 to 5	1	10%	1	14.29%
Total	10	100%	7	100%

Internet Connection Type

The type of connection to the Internet was similar for both the classroom group and the virtual group.

Internet Connection	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Dial-up	1	10%	1	14.29%
Cable	4	40%	5	71.43%
DSL	5	50%	0	0%
Office LAN	0	0%	1	14.29%
Other	0	00%	0	0%
Total	10	100%	7	100%

Team Use of VCS Tool

Team use of VCS	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Yes	1	10%	5	71.43%
No	0	0%	2	28.57%
No, classroom group	9	90%	0	0%
Total	10	100%	7	100%

Ranking of VCS Tool

VCS for Teamwork	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Outstanding	0	0%	1	14.29%
Very Good	1	10%	2	28.57%
Average	0	0%	1	14.29%
Below Average	0	0%	1	14.29%
Far Below Average	9	90%	2	28.57%
n/a	0	0%	0	0%
Total	10	100%	7	100%

Perceptions of VCS Tool for Teamwork

Classroom Group

Na

n/a

No used.

N/A

Na

Na

Na

N/A

N/A
we used the discussion board but did not set up anything for team meetings

Virtual Group

The software was a good tool for initial and intermediate team planning. However, for the in depth finalization of the project, face to face meetings were a must.

We met online to discuss the team presentation, but did not believe it was suitable for group work. We only tried using the virtual classroom software once, and from that experience decided that it would be much more efficient and effective to meet in person. The virtual classroom does not allow individuals to discuss topics back and forth as easily as meeting in person. You just can't say what you're thinking. Only one person can have the floor at a time. I truly believe it to be much more efficient and effective to meet in person for the group assignment.

It was poor becasue we could not hear each other and we where not sure what each other was talking about.

it was easier to meet online but it was hard control online resources.
storage area was good

Good forum to get together. Ease or use.

Met in person and via phone.

Number and Type of Meetings

Interesting, the classroom teams met more frequently on average (7.9 times) then the virtual teams (5.3 times) overall and more frequently via both online and live meetings. This may be an indication that the virtual team used more asynchronous tools to coordinate their collaboration.

	Classroom	Virtual
	Mean	Mean
Online meetings	2.6	1.429
Live meetings	5.3	3.857
Total	7.9	5.286

Perception of Meeting Methods

Classroom Group

Live

I was enrolled in the live version.

I prefer live meetings as an effective way to communicate. I still beleive the personal touch works in business or any other endevor your working on. Sometimes busienss will be done via online visual or audio tools due to circumstances and costs, I just think they are a better supplemental tool that a main tool for doing business.

N/A

Na

Na

Na

N/A

Live

NA

Virtual Group

If in regard to teamwork, both methods had their advantages. I believe with complicated projects could be completed successfully with both methods. If in regard to class sessions, virtual meetings were more beneficial for me personnally.

Live, as noted in question 12.

Virtual I felt that I paid more attention during the virual than I would during a traditional class.

Live it was easier to discuss the power points

live - to interact and get to know people

I think it is the combination of both live and virtual meetins that is the most beneficial.

Did not use virtual meetings!

Reported Problems

Classroom Group

Na

n/a

Not in virtual classroom.

N/A

No

Na

Na

N/A

N/A

Na

Virtual Group

There were the occasional inernet connection problems with audio; however, nothing near enough to be distracting.

I believe the virtual course to be a great tool in the learning process. The only issue that i can think of is that at times the audio would cut in and out. The audio seemed to be significantly better when Mr. Griffin posted a picture of himself instead of showing the live feed using a webcam.

Sometmes with the audio.

No

No

None

A few video and audio problems...not a big deal.

Course Difficulty Because of Delivery Method

Classroom Group

no.

no

I enjoyed the access to WEbct and the use of this online tool. It made the instructor and student interface and requirements more enjoyable.

N/A

No

No

Time constraints made it tough

No

No

more difficult because of the precise way the instructor demanded the work to be completed

Virtual Group

No, it was very educational and useful.

No

No

I knew this course was going to be a lot of work when i signed up for it. I wasn't surprised.

No

No

Nope, it was fine!

Miss Something Because of Selection?

Classroom Group

No

No

Not at all. I get bombarded with technology everyday. It's refreshing for me to come to class.

I feel the only thing I may have missed out on is the experience in itself, but that was of my choosing.

No

No

No

No

No

No

Virtual Group

I really do not feel I missed anything. The sessions were lively with discussion and I felt more focused being at home.

No. I really enjoyed the virtual course.

No

No, i felt that i had the same experience as the classroom student. Maybe even a better one. I think that i got more from this course than most because you had to pay close attention you were never sure when the instructor was going to call on you.

No

No

No.

Course Difficulties

Students were asked in what areas that had difficulty with the course. Student could indicate difficulty in more than one area.

Course Difficulties	Classroom		Virtual	
	Frequency	% of Students	Frequency	% of Students
Personal	2	20%	1	14.29%
Technical	1	10%	2	28.57%
Travel	1	10%	0	0%
Instructor	1	10%	1	14.29%
Departments	0	0%	0	0%
Material	0	0%	0	0%
Other	3	30%	1	

Technical Difficulties

Virtual Group

An occasional delay in audio. Nothing serious.

n/a

Sometimes I had trouble with the audio, it would break up every once in awhile.

I didn't have and problems

None

None

None

ILinc Usability

All seven students enrolled in the virtual course indicated that iLinc was "very easy to use.

More DL Classes?

All of the virtual class participants and all but one of the classroom participants, agreed that more distance learning classes should be taught at Saint Francis University.

More DL classes?	Classroom		Virtual	
	Frequency	Relative %	Frequency	Relative %
Yes	9	90%	7	100%
No	1	10%	0	28.57%
Total	10	100%	7	100%

Saint Francis University

Masters of Business Administration

MBA513
Electronic Commerce

Course Assessments

Fall 2007

Created: January 4, 2008
Last Revised: January 16, 2008

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MBA513 Module One

Module 1 Assessment of Learning

To establish a baseline of each participant's knowledge of the subject matter before the educational intervention, a pretest was administered to all study participants. Following the educational intervention conducted via the distance learning software Wimba, a posttest was completed by each participant. The analysis below shows the results of these tests for each of the six participants in the study and shows an average increase of **38.33%** on the subject matter test as determined by comparing each participant's scores.

	Pretest % Score	***Posttest % Score***	***Difference***
Participant 1	60%	60%	0%
Participant 2	40%	100%	60%
Participant 3	80%	100%	20%
Participant 4	60%	70%	10%
Participant 5	20%	100%	80%
Participant 6	20%	80%	60%
Average	46.67%	85.00%	38.33%

Module 1 Self-reported Assessment of Student Learning

After completion of Module 1, each student was asked to complete a survey instrument to gauge his or her self-perception of knowledge before and after the intervention for various course topics. The participants were provided the following four-point Likert scale to assess their knowledge about individual topics. Students rated their knowledge on individual topics before and after the educational intervention using this scale.

0 = Nothing about the topic
1 = Very little about the topic
2 = Something about the topic
3 = A great deal about the topic

Using this scale, 3 items were assessed for each topic.

First, a proportion of participants that reported a decrease, increase, or no change in knowledge about a particular topic was presented in a table. Second, the average change in knowledge level for participants was calculated and was presented in narrative form. Third, since the ultimate goal is to bring students knowledge level to a high level after the intervention, this information was examined. This information was displayed in a table that shows the proportion of students at the various knowledge levels after the educational intervention.

Question 1 and 2

A topic covered in eBusiness 513 was history of business before the advent of eBusiness (otherwise called the Prehistory of eBusiness).

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	16.67%
Increase in knowledge level	5	83.33%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.167.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	5	83.33%
A great deal about the topic	1	16.67%
Total	6	100.00%

Question 3 and 4

A topic covered in eBusiness 513 was a discussion of why you should study eBusiness as a separate function of business.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	0	0.00%
Increase in knowledge level	6	100.00%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.667.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	3	50.00%
A great deal about the topic	3	50.00%
Total	6	100.00%

Question 5 and 6

A topic covered in eBusiness 513 was development of a context, or paradigm, to use to discuss eBusiness. This was the C2C, B2B, B2C, and G2C model.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	0	0.00%
Increase in knowledge level	6	100.00%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.5.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	5	83.33%
A great deal about the topic	1	16.67%
Total	6	100.00%

MBA513 Module Two

Module 2 Assessment of Learning

To establish a baseline of each participant's knowledge of the subject matter before the educational intervention, a pretest was administered to all study participants. Following Module 2 conducted via the distance learning software Wimba, a posttest was completed by each participant. The analysis below shows the results of these tests for five participants in the study and shows an average increase of **35%** on the subject matter test as determined by comparing each participant's scores. Note: One of the participants did not take the pretest and was excluded from this analysis.

	Pretest % Score	*Posttest % Score*	*Difference*
Participant 1	40%	90.00%	50.00%
Participant 2	20%	85.00%	65.00%
Participant 3	60%	70.00%	10.00%
Participant 4	40%	75.00%	35.00%
Participant 5	60%	75.00%	15.00%
Average	44.00%	79%	35.00%

Module 2 Self-reported Assessment of Student Learning

After completion of the Module 2, each student was asked to complete a survey instrument to gauge his or her self-perception of knowledge before and after the intervention for various course topics. The participants were provided the following four-point Likert scale to assess their knowledge about individual topics. Students rated their knowledge on individual topics before and after the educational intervention using this scale.

0 = Nothing about the topic
1 = Very little about the topic
2 = Something about the topic
3 = A great deal about the topic

Using this scale, 3 items were assessed for each topic.

First, a proportion of participants that reported a decrease, increase, or no change in knowledge about a particular topic was presented in a table. Second, the average change in knowledge level for participants was calculated and was presented in narrative form. Third, since the ultimate goal is to bring students knowledge level to a high level after the intervention, this information was examined. This information was displayed in a table that shows the proportion of students at the various knowledge levels after the educational intervention.

Question 1 and 2
A topic covered in eBusiness 513 was a term called etailing.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	2	33.33%
Increase in knowledge level	4	66.67%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.167.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	3	50.00%
A great deal about the topic	3	50.00%
Total	6	100.00%

Question 3 and 4

A topic covered in eBusiness 513 was the vocabulary of the Internet. Terms such as splash page and homepage were discussed.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	0	0.00%
Increase in knowledge level	6	100.00%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.5.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	3	50.00%
A great deal about the topic	3	50.00%
Total	6	100.00%

Question 5 and 6

A topic covered in eBusiness 513 was a number of statistics detailing the scope of B2C business.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	16.67%
Increase in knowledge level	5	83.33%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.25.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	4	66.67%
A great deal about the topic	2	33.33%
Total	6	100.00%

Question 7 and 8

A topic covered in eBusiness 513 was a comparison between B2C (Business to Customer) and B2B (business to business).

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	2	33.33%
Increase in knowledge level	4	66.67%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **0.67.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	4	66.67%
A great deal about the topic	2	33.33%
Total	6	100.00%

Question 9 and 10

A topic covered in eBusiness 513 was the types of B2B business. Topics such as extranet and infomediary were discussed.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	16.67%
Increase in knowledge level	5	83.33%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.5.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	4	66.67%
A great deal about the topic	2	33.33%
Total	6	100.00%

Question 11 and 12

A topic covered in eBusiness 513 was some general facts and statistics about B2B.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	2	33.33%
Increase in knowledge level	4	66.67%
Total	6	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.0.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	5	83.33%
A great deal about the topic	1	16.67%
Total	6	100.00%

MBA513 Module Three

Module 3 Assessment of Learning

To establish a baseline of each participant's knowledge of the subject matter before the educational intervention, a pretest was administered to all study participants. Following Module 3 conducted via the distance learning software iLinc, a posttest was completed by each participant. The analysis below shows the results of these tests for five participants in the study and shows an average increase of **48%** on the subject matter test as determined by comparing each participant's scores. Note: One participant did not take the pretest and was excluded from this analysis.

	Pretest % Score	*Posttest % Score*	*Difference*
Participant 1	50%	100.00%	50.00%
Participant 2	50%	100.00%	50.00%
Participant 3	0%	100.00%	100.00%
Participant 4	80%	100.00%	20.00%
Participant 5	80%	100.00%	20.00%
Average	52.00%	100%	48.00%

Module 3 Self-reported Assessment of Student Learning

After completion of the Module 3, each student was asked to complete a survey instrument to gauge his or her self-perception of knowledge before and after the intervention for various course topics. The participants were provided the following four-point Likert scale to assess their knowledge about individual topics. Students rated their knowledge on individual topics before and after the educational intervention using this scale. Note: For Module 3, only 4 participants completed this part of the study.

0 = Nothing about the topic
1 = Very little about the topic
2 = Something about the topic
3 = A great deal about the topic

Using this scale, 3 items were assessed for each topic.

First, a proportion of participants that reported a decrease, increase, or no change in knowledge about a particular topic was presented in a table. Second, the average change in knowledge level for participants was calculated and was presented in narrative form. Third, since the ultimate goal is to bring students knowledge level to a high level after the intervention, this information was examined. This information was displayed in a table that shows the proportion of students at the various knowledge levels after the educational intervention.

Question 1 and 2
A topic covered in eBusiness 513 was C2C (Customer to Customer) business examples. In this topic we discussed eBay and Wikipedia as two examples of C2C businesses.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	25.00%
Increase in knowledge level	3	75.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.0.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	2	50.00%
A great deal about the topic	2	50.00%
Total	4	100.00%

Question 3 and 4
A topic covered in eBusiness 513 was file sharing businesses like Napster and their unique place in the marketplace.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	25.00%
Increase in knowledge level	3	75.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.5.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	3	25.00%
A great deal about the topic	1	75.00%
Total	4	100.00%

Question 5 and 6

A topic covered in eBusiness 513 was intranets (intranets as compared to internets). In this topic we discussed your own company intranets.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	2	50.00%
Increase in knowledge level	2	50.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **0.5.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	0	0.00%
A great deal about the topic	4	100.00%
Total	4	100.00%

Question 7 and 8

A topic covered in eBusiness 513 was a discussion of Google. You will recall that we discussed this topic as the Internets Internet.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	25.00%
Increase in knowledge level	3	75.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.0.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	1	25.00%
A great deal about the topic	3	75.00%
Total	4	100.00%

MBA513 Module Four

Module 4 Assessment of Learning

To establish a baseline of each participant's knowledge of the subject matter before the educational intervention, a pretest was administered to all study participants. Following Module 4 conducted via the distance learning software ePresence, a posttest was completed by each participant. The analysis below shows the results of these tests for each of the three participants in the study and shows an average increase of **37.5%** on the subject matter test as determined by comparing each participant's scores. Note: Two study participants did not complete the pretest and were excluded from this analysis.

	Pretest % Score	Posttest % Score	Difference
Participant 1	60%	95.00%	35.00%
Participant 2	100%	95.00%	-5.00%
Participant 3	40%	90.00%	50.00%
Participant 4	20%	90.00%	70.00%
Average	55.00%	92.50%	37.50%

Module 4 Self-reported Assessment of Student Learning

After completion Module 4, each student was asked to complete a survey instrument to gauge his or her self-perception of knowledge before and after the intervention for various course topics. The participants were provided the following four-point Likert scale to assess their knowledge about individual topics. Students rated their knowledge on individual topics before and after the educational intervention using this scale.

0 = Nothing about the topic
1 = Very little about the topic
2 = Something about the topic
3 = A great deal about the topic

Using this scale, 3 items were assessed for each topic.

First, a proportion of participants that reported a decrease, increase, or no change in knowledge about a particular topic was presented in a table. Second, the average change in knowledge level for participants was calculated and was presented in narrative form. Third, since the ultimate goal is to bring students knowledge level to a high level after the intervention, this information was examined. This information was displayed in a table that shows the proportion of students at the various knowledge levels after the educational intervention.

Question 1 and 2

A topic covered in eBusiness 513 was a description of G2C (Government to Customer) business and how it is really G2C, G2B, and G2G..

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	1	25.00%
Increase in knowledge level	3	75.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.25**.

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	3	25.00%
A great deal about the topic	1	75.00%
Total	4	100.00%

Question 3 and 4

A topic covered in eBusiness 513 was the forms of G2C business. This topic discussed how G2C was also G2B and G2G.

Result	N	Percentage
Decrease in knowledge level	0	0.00%
No change in knowledge level	0	0.00%
Increase in knowledge level	4	100.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **1.75.**

Post Knowledge Rating	N	Percentage
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	2	50.00%
A great deal about the topic	2	50.00%
Total	4	100.00%

Question 5 and 6
A topic covered in eBusiness 513 was some general facts and statistics about G2C.

Result	*N*	*Percentage*
Decrease in knowledge level	0	0.00%
No change in knowledge level	0	0.00%
Increase in knowledge level	4	0.00%
Total	4	100.00%

For each participant, a change in self-reported knowledge level was calculated. For this topic, the students reported an average increase in knowledge level of **2.0.**

Post Knowledge Rating	*N*	*Percentage*
Nothing about the topic	0	0.00%
Very little about the topic	0	0.00%
Something about the topic	2	50.00%
A great deal about the topic	2	50.00%
Total	4	100.00%

VCS Tool Usability Analysis

VCS Usability Software Survey Summary (Wimba)

After completion of Module 1 and Module 2 of the course, each student was asked to complete a survey instrument to gauge the usability of the virtual classroom software that was being used to administer the course. The results of this survey are shown below

Question 1
What software are you evaluating?

	N	Percentage
a. iLinc	0	0%
b. Wimba	6	100%
c. ePresences	0	0%
Total	6	100%

Question 2
How do you rate this software in terms of ease of use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	16.67%
b. B	1	16.67%
c. C	4	66.67%
d. D	0	0%
e. **Worst**	0	0%
f. Does not apply	0	0%
Total	6	100.00%

Question 3
How do you rate this software for audio? Rank from A as the Best to E as the Worst.

a. **Best**
b. **B**
c. **C**
d. **D**
e. **Worst**
f. **Does not apply**

	N	Percentage
a. **Best**	0	0%
b. B	3	50%
c. C	3	50%
d. D	0	0%
e. **Worst**	0	0%
f. Does not apply	0	0%
Total	6	100.00%

Question 4
How do you rate this software for video? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	16.67%
b. B	0	0%
c. C	4	66.67%
d. D	1	16.67%
e. **Worst**	0	0%
f. Does not apply	0	0%
Total	6	100.00%

Question 5
How do you rate this software for whiteboard? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	1	16.67%
c. C	5	83.33%
d. D	0	0%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	6	100.00%

Question 6
How do you rate this software for PowerPoint? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	5	83.33%
c. C	1	16.67%
d. D	0	0%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	6	100.00%

Question 7
How do you rate this software for having an intuitive interface? Did you find the software easy to manipulate and did you find the features easy to use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	16.67%
b. B	1	16.67%
c. C	2	33.33%
d. D	2	33.33%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	6	100.00%

Question 8
The VCS software allows the instructor to record a class. Did you use any of the recordings to review a class?

	N	Percentage
a. I didn't use it	4	66.67%
b. 1	1	16.67%
c. 2	1	16.67%
d. 3	0	0%
e. 4	0	0%
f. 5	0	0%
g. More than 5	0	0%
Total	6	100.00%

Question 9
What feature or features was the most beneficial to your class? Why?

I found the quick answers next to the list of names the most beneficial. It was often hard to coordinate the questions and answers between users so it was nice to have the check, ex, and hand-raising buttons.

The video, audio and ability to write and answer without holding up class for a one word answer.

hand raising, yes/no check marks, push to talk

The audio and video... although it was difficult to hear when another student would speak at times. This was due to distortion when two people are speaking around the same time. This being said, it was very helpful to hear and see the professors presentation... it allowed me to stay very engaged as if in a normal class room.

None

being able to save the slides. overall I have not been very impressed with it.

Question 10
What feature or features was the least beneficial to your class? Why?

The talk button was the least beneficial. As mentioned above, it was often hard to coordinate talk time between users. I much prefered the chat function or quick buttons.

I believe all features were used to the fullest. I would have to say the class recordings, just because I did not have to use it very often.

chat feature........ I did not find this useful, but could imagine instances where it could be

The white board. Not much use for it and when students all write on it you could have your information blotted out by someone writing in the same place.

None

instant messenger did not allow private chats

Question 11
How many classes (other than the class we held in the classroom) did you participate in from your office?

	N	Percentage
a. 0	5	83.33%
b. 1	1	16.67%
c. 2	0	33.33%
d. 3	0	0%
Total	6	100.00%

Question 12
How many classes (other than the class we held in the classroom) did you participate in from your home?

	N	Percentage
a. 0	1	16.67%
b. 1	0	0%
c. 2	1	16.67%
d. 3	2	33.33%
e. 4	2	33.33%
Total	6	100.00%

Question 13
How many classes (other than the class we held in the classroom) did you participate in from another location?

	N	Percentage
a. 0	4	66.67%
b. 1	1	16.67%
c. 2	0	0%
d. 3	1	16.67%
Total	6	100.00%

Question 14
If you answered another location to the previous question, please describe the location.

n/a

home

na

An office at the local Dixon Center University.

Amman-Jordan

Question 15
Do you have additional comments about the software?

It's hard to give a fair evaluation on Wimba until we've used the other software to compare.

I'm not sure of the other students in the class but this is my first experience with virtual classroom software so Wimba may very well be the best available at this point in time. I won't know for sure until I can test it against others.

Overall, very easy and effective. I appreciate SFU and Mr. Griffin providing such an advanced learning vehicle. I would like to see more online classes offered.

No

It was good to start with, however I am hoping our next software has better video and audio capabilities.

No

Question 16
During the course we used questions like the one shown above. Please rate the helpfulness of this technique.

	N	Percentage
a. Outstanding	2	33.33%
b. Very Good	3	50.00%
c. Average	1	16.67%
d. Below Average	0	0%
e. Far Below Average	0	0%
Total	6	100.00%

VCS Usability Software Survey Summary (iLinc)

After completion of Module 3, each student was asked to complete a survey instrument to gauge the usability of the virtual classroom software that was being used to administer the course. The results of this survey are shown below. Note: One student did not complete this survey.

Question 1
What software are you evaluating?

	N	Percentage
a. iLinc	5	100%
b. Wimba	0	0%
c. ePresences	0	0%
Total	5	100%

Question 2
How do you rate this software in terms of ease of use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	20%
b. B	1	20%
c. C	2	40%
d. D	1	20%
e. **Worst**	0	0%
f. Does not apply	0	0%
Total	5	100.00%

Question 3
How do you rate this software for audio? Rank from A as the Best to E as the Worst.

a. Best
b. B
c. C
d. D
e. Worst
f. Does not apply

	N	Percentage
a. **Best**	0	0%
b. B	2	40%
c. C	1	20%
d. D	0	0%
e. **Worst**	2	40%
f. Does not apply	0	0%
Total	5	100.00%

Question 4
How do you rate this software for video? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	1	20%
c. C	1	20%
d. D	1	20%
e. **Worst**	2	40%
f. Does not apply	0	0%
Total	5	100.00%

Question 5
How do you rate this software for whiteboard? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	20%
b. B	1	20%
c. C	3	60%
d. D	0	0%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	5	100.00%

Question 6
How do you rate this software for PowerPoint? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	1	20%
b. B	2	40%
c. C	2	40%
d. D	0	0%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	5	100.00%

Question 7
How do you rate this software for having an intuitive interface? Did you find the software easy to manipulate and did you find the features easy to use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	2	40%
c. C	1	20%
d. D	2	40%
e. **Worst**	0	0%
F. Does not apply	0	0%
Total	5	100.00%

Question 8
The VCS software allows the instructor to record a class. Did you use any of the recordings to review a class?

	N	Percentage
a. I didn't use it	3	60%
b. 1	1	20%
c. 2	1	20%
d. 3	0	0%
e. 4	0	0%
f. 5	0	0%
g. More than 5	0	0%
Total	5	100.00%

Question 9
What feature or features was the most beneficial to your class? Why?

1.the ability to scroll through web pages while Mr. Griffin talked about the specifics. 2.The ease of answering questions on the pie chart. 3.The sound notice to Mr. Griffin when the student hit the question icon.

feedback, Q&A feature

ability to save the power point presentation

I like the hand raising feature that alerts the presenter. The other software did not have this so it would be more difficult to get the presenter's attention.

Question 10
What feature or features was the least beneficial to your class? Why?

1. The video was horrible, the lag became very bothersome after trying to watch it for 2 hours. Most of the time I would minimize iLink so I would just watch the whiteboard. 2. Also audio was below average. It would fluctuate between clear to inaudible. 3. Not having control over your own camera was also a bit invasive. In that regard I preferred Wimba

I didn't like how the features did not define the user very well. I never could figure out how to send private chats to others in the class and when a hand was raised, I didn't know until the professor said, who it was. For interaction amongst classmates the software was not as beneficial as it could have been.

n/a

no comment

The webshare was a bit difficult at times because it did not function properly.
instant messenger did not allow private chats

Question 11
How many classes (other than the class we held in the classroom) did you participate in from your office?

	N	Percentage
a. 0	4	80%
b. 1	0	0%
c. 2	1	20%
d. 3	0	0%
Total	5	100.00%

Question 12
How many classes (other than the class we held in the classroom) did you participate in from your home?

	N	Percentage
a. 0	0	0%
b. 1	1	20%
c. 2	0	0%
d. 3	1	20%
e. 4	2	40%
f. more than 10	1	20%
Total	5	100.00%

Question 13
How many classes (other than the class we held in the classroom) did you participate in from another location?

	N	Percentage
a. 0	4	80%
b. 1	0	0%
c. 2	1	20%
d. 3	0	0%
Total	5	100.00%

Question 14
If you answered another location to the previous question, please describe the location.

N/A

N/A

n/a

I was in Jordan for two classes. They went well.

Question 15
Do you have additional comments about the software?

Overall, I would give it a 7 out of 10. I think the features were more user friendly than Wimba. However, the Wimba video, audio and camera control were much better.

I did not like it at all compared to Wimba. We'll see how ePresence ranks but I can foresee this software being my least favorite.

n/a

not very friendly. Video is not that great. Could not IM a specific person.

Question 16
Please rank the two VCS tools used in this course to date?

4 students ranked (1. Wimba, 2. iLinc)
1 student ranked (1. iLinc, 2. Wimba)

VCS Usability Software Survey Summary (ePresence)

After completion of Module 4, each student was asked to complete a survey instrument to gauge the usability of the virtual classroom software that was being used to administer the course. The results of this survey are shown below. Note: Two students did not complete this survey.

Question 1
What software are you evaluating?

	N	Percentage
a. iLinc	0	0%
b. Wimba	0	0%
c. ePresences	4	100%
Total	4	100%

Question 2
How do you rate this software in terms of ease of use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	0	0%
c. C	0	0%
d. D	2	50%
e. **Worst**	2	50%
f. Does not apply	0	0%
Total	4	100.00%

Question 3
How do you rate this software for audio? Rank from A as the Best to E as the Worst.

a. **Best**
b. **B**
c. **C**
d. **D**
e. **Worst**
f. **Does not apply**

	N	Percentage
a. **Best**	0	0%
b. B	0	0%
c. C	2	50%
d. D	0	0%
e. **Worst**	2	50%
f. Does not apply	0	0%
Total	4	100.00%

Question 4
How do you rate this software for video? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	1	25%
c. C	2	50%
d. D	0	0%
e. **Worst**	1	25%
f. Does not apply	0	0%
Total	4	100.00%

Question 5
How do you rate this software for whiteboard? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	0	0%
c. C	0	0%
d. D	0	0%
e. **Worst**	1	25%
f. Does not apply	3	75%
Total	4	100.00%

Question 6
How do you rate this software for PowerPoint? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	0	0%
c. C	0	0%
d. D	0	0%
e. **Worst**	1	25%
F. Does not apply	3	75%
Total	4	100.00%

Question 7
How do you rate this software for having an intuitive interface? Did you find the software easy to manipulate and did you find the features easy to use? Rank from A as the Best to E as the Worst.

	N	Percentage
a. **Best**	0	0%
b. B	0	0%
c. C	1	25%
d. D	1	25%
e. **Worst**	2	50%
F. Does not apply	0	0%
Total	4	100.00%

Question 8
The VCS software does not allow the instructor to record a class. Did you find this to be a problem?

	N	Percentage
a. Yes	3	75%
b. I did not notice	1	25%
c. No	0	0%
Total	4	100.00%

Question 9
What feature or features was the most beneficial to your class? Why?

Not enough time with this software to determine that.

NONE

Video feed from all participants

We did not use the software for an entire class so my answers are not complete. The feature that I did like was that you could see all of your classmates up on the screen.

Question 10
What feature or features was the least beneficial to your class? Why?

I think the video links to ALL class members did not add any value, in fact, I think it was rather distracting.

NONE

the fact that it didnt work

Not being able to record the class would be the least beneficial "non feature".

Question 11
How many classes (other than the class we held in the classroom) did you participate in from your office?

	N	Percentage
a. 0	4	100%
b. 1	0	0%
c. 2	0	0%
d. 3	0	0%
Total	4	100.00%

Question 12
How many classes (other than the class we held in the classroom) did you participate in from your home?

	N	Percentage
a. 0	0	0%
b. 1	4	100%
c. 2	0	0%
d. 3	0	0%
e. 4	0	0%
f. more than 10	0	0%
Total	4	100.00%

Question 13
How many classes (other than the class we held in the classroom) did you participate in from another location?

	N	Percentage
a. 0	4	100%
b. 1	0	0%
c. 2	0	0%
d. 3	0	0%
Total	4	100.00%

Question 14
If you answered another location to the previous question, please describe the location.

N/A

N/A

n/a

n/a

Question 15
Do you have additional comments about the software?

Even though we did not have much time with it, it does not seem very good.

NO

I think this software has potential once the bugs are worked out

Question 16
The VCS software does not allow the instructor to us polling questions. Did you find this to be a problem?

	N	Percentage
a. Yes	3	75%
b. I did not notice	1	25%
c. No	0	0%
Total	4	100.00%

Questions 17 through 21 seem to be redundant

Question 22
Please rank the VCS tools used in this course to date?

3 students ranked (1. Wimba, 2. iLinc, 3. ePresence)
1 student ranked (1. Wimba, 2. ePresence, iLinc)

Comparative Analysis

Comparative Assessment of Learning

For each of the four modules which used various VCS tools, a pretest was administered to establish a baseline of participant's knowledge. After the module was completed, at posttest was administered to attempt to assess student learning. The table below represents the average pretest, posttest, and difference scores for each of the three course modules. It is difficult to gauge the impact of the VCS in student learning especially since the knowledge of the material prior to intervention varied greatly between modules, however in each module the students achieved a proficient average on the subject matter and were able to greatly increase their exam scores.

	N	**Mean Pretest % Score**	**Mean Posttest % Score**	**Mean Difference**
Module 1 (Wimba)	6	46.67%	85.00%	38.33%
Module 2 (Wimba)	5	44.00%	79.00%	35.00%
Module 3 (iLinc)	5	52.00%	100.00%	48.00%
Module 4 (ePresence)	4	55.00%	92.50%	37.50%

Comparative Self-reported Assessment of Learning

After completion of each of the four modules which each used various VCS tools, students were asked to gauge his or her self-perception of knowledge before and after the intervention. The table below represents the average increase of knowledge level within the scale provided on various course topics. It is difficult to gauge the impact of the VCS in student learning especially since the knowledge of the material prior to intervention varied greatly between modules, however in each module the students report an average increase of knowledge level change as a result of the intervention.

	N	**Mean Knowledge Level Change**
Module 1 and 2 (Wimba)	9	1.325
Module 3 (iLinc)	4	1.000
Module 4 (ePresence)	3	1.667

Comparative VCS Usability Survey Summary

After students were done using each VCS tool, each student was asked to complete a survey instrument to gauge the usability of the virtual classroom software that was being used to administer the course. Each response regarding various aspects of the usability were recorded by students on a 5 point Likert scale with 5 indicating "Best" usability and 1 indicating "Worst" usability. A class average on each of these measures was calculated and is displayed in the table below.

	Wimba	**iLinc**	**ePresence**
Ease of Use	4.167	5.00	3.00
Audio	3.50	3.2	1.50
Video	3.50	2.2	1.50
Whiteboard	3.00	1.6	3.25
PowerPoint	3.167	3.6	1.00
Intuitive Interface	3.83	2.6	1.00
Recording	4.50	4.44	n/a
Average	3.67	3.23	1.875

Additionally, all students were asked to rank each VCS that they had used to date. After using two VCS tools, four students ranked Wimba over iLinc with only 1 student choosing iLinc over Wimba.

After all VCS tools were introduced, all students rated Wimba as the best software tool. This overall assessment reinforces the synthesized average calculated above for each feature.

Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Continuing Distance Education for Rural Pharmacists

Protocol No.: 05-TATDL202-05

Date: March 12, 2008

Protocol Title: Continuing Distance Education for Rural Pharmacists

Principal Investigator: Kristine Anderson

Protocol Executive Summary:

The study focused on the design and delivery of pharmaceutical distance education. The courses developed in the study were in response to the need for development and research of accredited online learning. Pharmacists and pharmacy technicians are required to participate in continuing education to maintain their state medical license. These courses have been developed and approved in conjunction with Accreditation Council of Pharmacy Education (ACPE) guidelines. In the study, the courses were examined by the affective response of students that participated to evaluate their participation. Also, a literary research was conducted to determine the qualities that make a pharmacist or pharmacy technician a good candidate for distance education, identify topics in pharmacy education that are in need of additional continuing education, and assess the distance learning techniques and methodology to provide continuing education for pharmacists and pharmacy technicians.

The purpose of this study was to measure the effectiveness of multiple learning techniques utilized in distance education to deliver continuing education courses to licensed pharmacists and pharmacy technicians in rural and underserved areas. For pharmacists and pharmacy technicians in areas like these, it is difficult to receive traditional educational opportunities. Participants in the study received the course contents by Internet webinars, online monographs, and by U.S. mail monographs.

The first type of pharmaceutical distance education programs researched was the online webinars. The courses developed and delivered were Insulin Therapy for Diabetes, Asthma: The Challenge of Children, Minorities, and Low-income Population, The Pharmacists' Role in Treating Hypertension and Pharmacological Help for A Good Night's Sleep. The course objectives for each program, a summary of the production techniques to develop them, and the student affective responses are reported.

The next type of delivery researched was the online monographs. The courses developed and delivered were Treatment of Anemia, Treatment of Congestive Heart Failure, and Better than Counting Sheep: Treating Insomnia. The course objectives for each program, a summary of the production techniques to develop them, and the student affective responses are reported.
The final type of delivery researched was the mailer monographs (with and without an active learning activity). The courses developed and delivered were Native American Medicines and Smoking Cessation. The course objectives for each program, a summary of the production techniques to develop them, and the student affective responses are reported.

This study results and implications have been presented at the 2007 American Educational Research Association's New England Educational Research Organization in Portsmouth, New Hampshire. The study also transitioned into a business plan with a letter of agreement with Pharmaceutical Consultants Inc. (PharmCon) to provide online pharmacy education programs.

From January to March 2008 the investigator will seek educational science journals and industry magazines for possible article publication.

Introduction:

The study's objective was to provide effective online learning that applies instructional design as appropriate in the distance learning environment, to increase the knowledge and apply accreditation credits to pharmacists and pharmacy technicians in rural and underserved areas. The study identified effective online delivery methods, evaluation techniques, and instructional methodology for potential continuing education providers to implement in their medical programming.

The medical topics in the study were selected from focus groups of pharmacists and an industry analysis of new medications and treatments to be released in the pharmaceutical market. A team of subject matter experts, instructional designers, and multimedia production specialists developed the online programs. The programs were then studied by pharmacists and pharmacy technicians world-wide. The students in the study included retail, corporate (managed care), health care facilities (hospital, skilled nursing facility, etc.), research institutes, marketing firms, and military members. The online programs have especially been beneficial for members of the military. Several military pharmacists participated in the programs stateside and around-the-world. For example, four pharmacists located at the Ali Al Salem and Ahmed Al Jaber United States Air Force bases in Kuwait attended the asthma webinars.

The study examined delivery methods to these audiences that included traditional distance education and emerging online methods. In 1965, the state of Florida was the first to implement mandatory continuing education for pharmacists. Today, all 50 states except for Hawaii require pharmacists to participate in accredited or approved continuing education (Driesen, Verbeke, Simoens, & Laekeman, 2007). The Accreditation Council for Pharmacy Education (ACPE) sets accreditation standards and accredits continuing education providers, rather than individual continuing education activities (ACPE, 2008). This study extends to measure the effectiveness of its programming by conducting affective assessments to determine the quality and potential of each program, the instructional methodology implemented, and the delivery format utilized.

Methods:

The research methods implemented in the study are an analysis among the research questions posed. This investigation consists of a review of pedagogical theories and literature, student affective assessments, and a review of the procedures to offer various delivery methods of accredited online education. Several procedures were implemented to conduct the quantitative and qualitative data analysis of each method.

The first research question asked to determine the effectiveness of asynchronous learning on student performance. The rates of student interest and completion were collected to determine the successfulness of each student and the educational program. The statistics and grades are reported along with the implications and follow-up discussion on reasons for the mentioned outcomes.

The second research question asked to evaluate the affective response of student participation in asynchronous events. This research question was explored by conducting affective assessments with the subjects that participated in the study. (These assessments can be found in the appendix section.) After a subject completed an educational event in the study, an affective assessment was completed to gather the subject's thoughts and opinions regarding the instructional intervention. The outcomes of the assessments were analyzed and reported. A description of the frequency distribution and a graph for each is reported in the results and analysis section.
The third research question asked to assess the distance learning techniques and methodology to provide asynchronous learning. A review of the literature was conducted to identify effective pedagogical theories for instructional design and evaluation of the programs. Also a description of the multimedia production and delivery of each instructional method is outlined.

The fourth research question asked to determine the qualities in a person that deems them a good candidate for a distance learning educational experience. A review of the literature was conducted to identify effective pedagogical theories to understand and educate potential students of the character qualities and study habits to have before participating in an online event. The description of each of these and the resulting implications are defined in the study.

Results and Analysis:

The analysis of student interest and successfulness of completing an educational course is important to understand the effectiveness of the program. The first question asked to determine the effectiveness of asynchronous learning on student performance. A survey of student interest was collected in the webinar programs. The webinars were delivered online between March and July 2007. The following statistics were obtained from the pharmacy webinar website, where users must login to access the information and this access is logged. The first three webinars conducted, focused on being accessible and easy-to-use since this was the first time that this technology was being implemented on a large international level with pharmacists and pharmacy technicians online.

The first topic to be addressed was Insulin Therapy for Diabetes. There were 460 people that clicked on the link for more information, of those, 390 (85%) registered for the program. Then 292 (75%) attended the session, of them, 164 (56%) completed the course survey. The 25% that registered but did not attend the program were followed up with to find out why they did not attend. The reasons cited included, that it was the first time they used the webinar software, some students had Internet connection problems, phone problems (calling in to conference call), and other technology problems (computer/access problems). Another reason cited was the webinar was competing with popular television shows in the same time slot (American Idol, Lost), family, work commitments, and simply forgot about the webinar.

The next topic of the webinars was Asthma: The Challenge of Children, Minorities, and Low-income Population. There were 636 people that clicked on the link for more information, of those, 516 (81%) registered for the program. Then 314 (61%) attended the session, of them, 174 (55%) completed the course survey. The 39% that registered but did not attend the program were followed up with to find out why they did not attend. The students that did not attend reported the same reasons as for the insulin webinar.

The final topic of the webinars was The Pharmacists' Role in Treating Hypertension. There were 460 people that clicked on the link for more information, of those, 390 (85%) registered for the program. Then 292 (75%) attended the session, of them, 137 (47%) completed the course survey. The 25% that registered but did not attend the program were followed up with to find out why they did not attend. The students that did not attend reported the same reasons as for the insulin and asthma webinars.

The study addressed the concerns cited by the students to increase recruitment and retention rates of the students. For students that were accessing incorrect websites, the webpage for the program was revised with clearer instructions and links. The webinars also included technical support by technicians being available online and on the phone for the students. This greatly reduced problems such as Internet connection problems and other technology/computer-related problems. Also, the webinars were originally sending audio over the telephone but to address students' concerns the audio was streamed online. That way the students were not tying up the phone line for an hour or making a long distance call. As for competing with popular television shows, family, and work commitments the webinars were then offered on different times and days of the week so the students could choose which ones met their scheduling requirements the best.

The online monographs were posted on the website for people to enroll and data was collected from July to September 2007. The monographs were: Treatment of Anemia (362 students), Treatment of Congestive Heart Failure (214 students), and Better than Counting Sheep: Treating Insomnia, (319 students). The students that participated responded that they enjoyed the self-paced course which could be completed at home. The completion of the course survey was required to receive credit for the course. This was implemented so that everyone involved in the course would complete a survey. However, as in coordination with the IRB, they still have the option to refuse to answer any question in the survey.

The mailer monographs were mailed out and data was collected from December 2007 to January 2008. The monographs were: Native American Medicines, with 26 students and Smoking Cessation, with 7 students (as of January 2008). The mailer program was the preferred method for pharmacists and pharmacy technicians over age 41. The majority of the webinar pharmacists were younger pharmacists accessing the programs from home computers.
There were four webinars in the study. The dates delivered, title, and objectives for each are listed below.

The first webinar was conducted on 3/21/07 on Insulin Therapy for Diabetes. The objectives were (1) Identify the mechanisms of action, pharmacology, and other important information for insulin therapy used to treat both types of diabetes and (2) Categorize the practical and essential information that has application in the daily pharmaceutical practice.

The next webinar conducted on 4/4/07 (and repeated on 5/2/07) was, Asthma: The Challenge of Children, Minorities, and Low-Income Populations. The objectives were (1) Describe the highest risk asthma populations, (2) Outline the significant features of the asthma management guidelines, (3) Describe adherence issues and methods to overcome difficulties, and (4) Describe new advances in the diagnosis and pharmacological treatments of asthma.

The third webinar was conducted on 4/11/07 (and repeated on 5/9/07) was The Pharmacist's Role in Treating Hypertension. The objectives were (1) Enhance your understanding of hypertension to include cardiovascular risks, management, and goals for individual patients, (2) Review and discuss the current pharmacotherapy standards of care for hypertension, and (3) Describe the pharmacist's role in counseling patients on hypertensive medications.

The final webinar was conducted on 7/6/07 (and repeated on 7/11/07) was on Pharmacological Help for A Good Night's Sleep. The objectives were (1) Define insomnia and characterize the symptoms and array of causes, (2) Describe traditional and newer pharmacologic approaches to the management of insomnia, (3) Evaluate the comparative efficacy, pharmacokinetics, and contraindications of agents used in the treatment of insomnia, and (4) List strategies for pharmacists to educate and counsel patients with insomnia.

There were three online monographs in the study. The title and objectives for each are listed below.

The first online monograph was on Treatment of Anemia. The objectives were (1) Describe the classifications of anemia, (2) Identify underlying causes and conditions associated with anemic disorders, (3) Describe the more common anemias, (4) Describe the clinical presentation of anemia, (5) Identify normal lab values versus lab values found in active disease, and (6) Differentiate between appropriate treatment options.

The second online monograph was on Treatment of Congestive Heart Failure (CHF). The objectives were (1) Discuss the patho-physiology of the heart that contributes to the development and progression of CHF, (2) Identify underlying disorders associated with the development of CHF, (3) Discuss non-pharmacological measures as well as first line pharmacological treatment options, (4) Identify pharmaceutical classes used in the treatment of CHF, (5) Discuss affects of pharmacological treatments on morbidity and mortality of the heart failure patient, (6) Differentiate between pharmaceuticals used in long term management versus those used to treat the acutely de-compensated heart failure patient, (7) Identify the most recent peptide marker used in the diagnosis of the CHF patient, and (8) Discuss the pharmacology of IV medications used in the acute care setting.

The final online monograph was Better than Counting Sheep: Treating Insomnia. The objectives were (1) Define the prevalence of insomnia and the estimated economic costs of insomnia in the United States, (2) Describe the pharmacological approaches to the management of insomnia (short and long term) and their therapeutic mechanisms of action, (3) Describe the comparative efficacy, pharmacokinetics, and contraindications of agents used in the treatment of insomnia, and (4) List strategies for pharmacists to educate and counsel patients on appropriate sleep habits.

There were two mailer monographs in the study. The title and objectives for each are listed below.

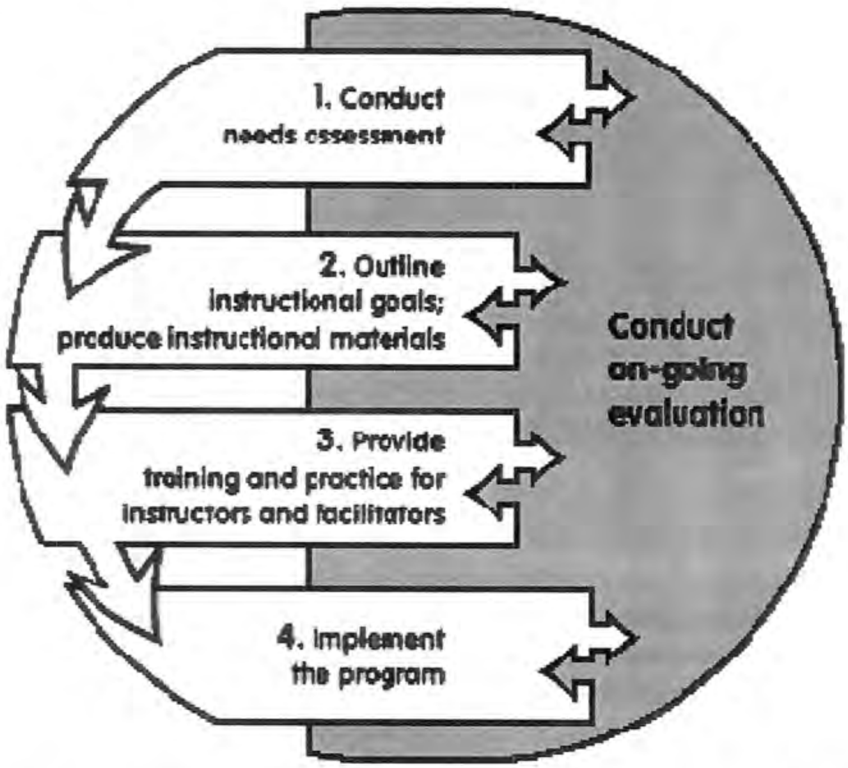
The first mailer monograph was on Native American Medicines. The objectives were (1) Identify a brief history of Indian tribes that used the natural products discussed, (2) Classify the differences between philosophies of western medicines and Native American products, (3) Identify the natural products for their prescribed treatments, (4) Demonstrate an understanding of the therapeutic uses of each of these natural agents, and (5) Illustrate the information provided in this program to patients in a less complex manner.

The final mailer monograph was on Smoking Cessation. The objectives were (1) Explain the toxic actions and health complication of tobacco use with emphasis on nicotine's addictive properties, (2) Identify the latest drug therapies used in nicotine replacement therapy, their mechanisms of action and delivery forms, and (3) Review the role in counseling patients on drug treatment strategies and medication adherence and means to enhance efforts to stop smoking. All of the educational programs were very successful and scored very high for covering the objectives, applying to their practice/patient care, and overall evaluation of the activity (see Appendix B for a complete list of results). The students reported that the instructor did a good job of writing the programs and delivering the online lectures. It was interesting that the webinars attracted a younger population of pharmacists while the majority of the traditional mailer monographs were students 41 and older. The traditional method of distance education was researched to see if active learning activities would increase student scores and affective responses. However, it did not have any significance as all the students passed the courses. The affective responses were also very similar for both groups (see Appendix B for the comparison). The students' satisfaction with each additional program increased. The instructional design model with a focus on a constant evaluation (as discussed further below) resulted in better and better continuing education programs as attention was made to keep increasing the quality of technology to deliver the programs and the quality of the content of the programs. This focus on quality education resulted in students referring others to the courses and repeat students in the programs (see Appendix B).

The next research question refers to the description of the techniques for the instructional design process, evaluation, and production of the webinars, online monographs, and mailer monographs. The first step to this process was a needs analysis to determine the pharmaceutical topics and concerns which pharmacists requested training in. A review of public health issues of concern in the media was air pollution (e.g.: emissions and diesel fuel). Air pollution can affect health in many ways with both short-term and long-term effects. The United States Environmental Protection Agency (EPA) reports that national average air quality continues to improve as emissions decline through 2006 (EPA, 2008). Therefore, it is important to continue efforts to improve the quality of the air to help prevent chronic illnesses like asthma. The asthma webinar was developed to address these environmental concerns and the short-term and long-term effects they can have on people. Additionally, research of national health data shows an increasing trend of chronic diseases. The Centers for Disease Control and Prevention (CDC) report of Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest telephone survey that tracks health risks in the United States. The data show an increasing trend of diabetes, hypertension, and lack of patient management skills to control their disease (CDC, 2005). Finally, pharmacy focus groups and survey questions asking what other educational programs they would like to be offered identified the remaining educational courses in the study. The first request was for additional information on Native American natural therapeutic remedies and the Native American Medicines course was created. The Native American Medicines course was a natural therapeutic medicine course. The course contained information of natural herbal remedies for ailments that continue to be used in medicine today. Also a request by the students was for content that investigates into new medications and treatments; and so the insomnia courses and the smoking cessation course were created due to new medications released into the market in 2007 for these ailments.

The implementation of distance learning technologies requires careful planning. The figure below (Figure 1) illustrates the major phases in the implementation process.

Figure 1
Instructional Design Model



The Florida Center for Instructional Technology recommends the following steps for proper techniques of implementing distance education (Barron, 1999). The first step is to conduct a needs assessment. The needs assessment identified the topics to be taught, the requirements and forms to be competed to receive ACPE accreditation for each course. The analysis also identified the technical requirements of each delivery format researched in the study.

The next step was to outline instructional goals and objectives and produce the instructional materials. A well-structured distance learning course must place instructional objectives foremost (Barron, 1999). The objectives for each course were established and subject matter experts developed the content for the webinars, online monographs, and mailer monographs. All of the materials were approved by a licensed medical doctor before being released to students.

The technology should be as invisible as possible, just another tool that instructors can use to effectively convey the content and interact with students (Barron, 1999). The technical requirements to produce and deliver the content were established. The webinars consisted of a pre-recorded audio lecture and PowerPoint presentation that was hosted online. At a certain time, students would login to the website to participate. The website also had a chat room and discussion area to ask the instructor questions or to request technical support. The online webinars required web pages that could display the monograph and collect quiz data that could be graded. The mailer monographs were created using desktop publishing software and were distributed by the postal mail.

The third step provided training and practice for instructors in the webinar courses. The online monographs and mailer monographs were static courses that did not require an instructor to be present. However, the live webinars required an instructor to participate in the question and answer sessions. Many of the techniques and skills used in a classroom teaching situation do not translate directly into a distance education approach. Instructor training programs are important to acquaint the instructor with the use of technology as well as to help with the redesign of the instructional strategies. The course instructor was trained in understanding distance education and how to operate the webinar software. The instructor improved his delivery and instructional methods with each webinar. An increase in the students' affective responses can be seen in the figures previously presented.

The final step is to implement the program. After the training is complete and a pilot test has been conducted to ensure the technology is functioning, the programs were implemented. The feedback from students was collected and accreditation paperwork was filed. The ACPE paperwork included the letter of agreements, faculty review, and beta testing to determine the amount of continuing education units to assign to a course of study.

During this whole process a constant, on-going evaluation was conducted to provide quality assurance. This process extended to the delivery of courses that are medically correct, technically savvy, and provided a constant stream of student feedback to address concerns as they occurred. A final research question sought to identify the qualities in a person that deems them a good candidate for distance learning courses. As identified in the research of Ornstein and Hunkins (1998) they identified qualities of a good candidate. These qualities included a student that is self-motivated and self-disciplined, never (or at least rarely) procrastinates, resists constant distractions, feels alright about missing the social elements of traditional schools, communicates effectively through reading and writing, accepts critical thinking and decision making as part of the learning process, meets the minimum technology requirements for the course, and feels that high quality learning can take place without going to a traditional classroom.

The convenience of distance education can attract many adult students since it is flexible and can accommodate various schedules (Thomas, 2008). However, it may not be the best fit for every student. An instructor or provider of education should include suggestions in the syllabus of ideal qualities for a student to have before enrolling into a course at-a-distance. This study provided potential students with the mentioned list of qualities and expectations for students to keep in mind while participating in distance education. This process helps in the success of the student, instructor, and the educational programs.

In summary, the webinar method was the preferred distance learning technique according to the students in the study. The webinars were the most popular choice by the students. The data (see Appendix B) rated the webinars very favorably and when asked if they would return again, 99% responded that yes, they would return again for another webinar. Also, according to the surveys the majority of the students would recommend attending a webinar class to a colleague. The webinars were so successful in the study that a letter of agreement with a pharmaceutical education provider was contracted so the webinars could continue to be offered to pharmacists and pharmacy technicians.

Key Research Accomplishments:

The study has had importance for CERMUSA, the military, and the public. CERMUSA benefits from the study by owning unique educational content and courses that can be applied into other medical fields and research studies. The study has led to the development of a business plan for CERMUSA. The profits may also extend to offering services for the development, delivery, and support of the educational programs. This study has also conducted research of emerging methodologies and applications that can be applied into future studies. The outcomes of the study provide data and information for educational policy and application changes within the academic community and also provide literature content for future publications and presentations. Finally, the study provides proof-of-concept of delivery and support to large numbers of students at a distance in pharmacology.

The military benefits from access to accredited continuing education for those in remote locations. The pharmacists and pharmacy technicians in the military located around the world can participate with an Internet connection. They could benefit from learning the latest pharmaceuticals to be released in the marketplace and be educated on innovative patient consultation techniques. The public also benefits by having an informed pharmaceutical workforce who is aware of new medicines and treatment guidelines. This is also beneficial for patients for implementing effective patient consultation techniques.

Reportable Outcomes:

The reportable outcomes that have resulted from this research are listed below.

<u>Presentation</u>

- 2007 American Educational Research Association's New England Educational Research Organization in Portsmouth, New Hampshire

<u>Accepted for Presentation</u>

- 2008 United States Distance Learning Association National Conference in St. Louis, Missouri

<u>Business Plan</u>

- A letter of agreement with Pharmaceutical Consultants Inc. (PharmCon) to develop pharmaceutical educational programs for a fee.

Conclusions:

This study researched the qualities that make a pharmacist or pharmacy technician a good candidate for distance education by evaluating the affective response of student participation in these programs. The study assessed effective distance learning techniques and methodologies to provide continuing education in multiple delivery modes. This included webinars, online monographs, and mailer monographs (with and without an active learning activity). The topics were selected by determining areas in pharmacy education that are in need of additional training. The study worked with medical doctors, nurses, and medical technicians to develop this high quality content. The extensive content developed to teach pharmacists and pharmacy technicians on new medications and consultation guidelines was effective in its delivery and design. The content benefited the military and public by offering effective distance education programs to remote locations. Each of the delivery modes and programs were successful in providing valuable information on pharmacy education. This study has ended for FY 06 and now the lessons learned will be applied into the FY 07 Continuing Distance Education for Health Sciences protocol. The lessons learned here in pharmacy education will be beneficial when developing educational programs for other medical technician fields.

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Appendices:

The appendixes attached are the affective assessments and results for the study. The multimedia course elements (webinars, audio lectures, PowerPoints, and monographs) are archived and available by contacting the investigator.

Appendix A - Affective assessment questions
Appendix B - Results of the affective assessments

Appendix A

By completing this questionnaire, I indicate my consent to participate in the study. I understand confidentiality will be maintained. Continuing Distance Education for Rural Pharmacists Protocol Number: 05-TATDL202-05

1. Rate the effectiveness of how well the activity met the stated learning objectives: (list objective)
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

2. Did the activity avoid commercial bias/influence? (scale 1 to 10 commercial or educational?)
    a. Yes
    b. No
    c. Not Sure

3. Rate the effectiveness of how well the activity related to your practice needs:
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

4. Rate the effectiveness of how well the activity will help you improve patient care:
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

5. Rate the effectiveness of how well the instructor conveyed the subject matter: (preparation, organization, knowledge, presentation style, questions)
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

6. Rate the overall quality of the activity:
    a. Excellent
    b. Very Good
    c. Good
    d. Fair
    e. Poor

7. As a result of the activity, did you learn something new or verify information you already knew?

a. Learned something new
b. Verified prior knowledge

8. Age:

a. 17 and younger
b. 18-23
c. 24-30
d. 31-40
e. 41 and older

9. Gender:

a. Male
b. Female

10. Zipcode? ___________________

11. Please indicate your classification below:

a. Retail
b. Corporate (Managed Care)
c. Health Care Facilities (Hospital, Skilled Nursing Facility, etc.)
d. Research
e. Marketing
f. Military
g. Other

12. What is the best time of year to participate in continuing education and why?

13. How long did it take to complete the course and what motivational factors helped you to complete this course (i.e. I like to learn new things, need CEUs, enjoy learning, would like to receive a pin or something else of merit)?

14. Suggestions for future courses:

15. Other: (have you participated before, how did you find out, rate the ease of use, would you participate again, would you recommend program, your preferred method of CE, etc.?)

Appendix B

3/21/07 Insulin Therapy for Diabetes

Figure 1

Rate the effectiveness of how well the activity met the stated learning objectives

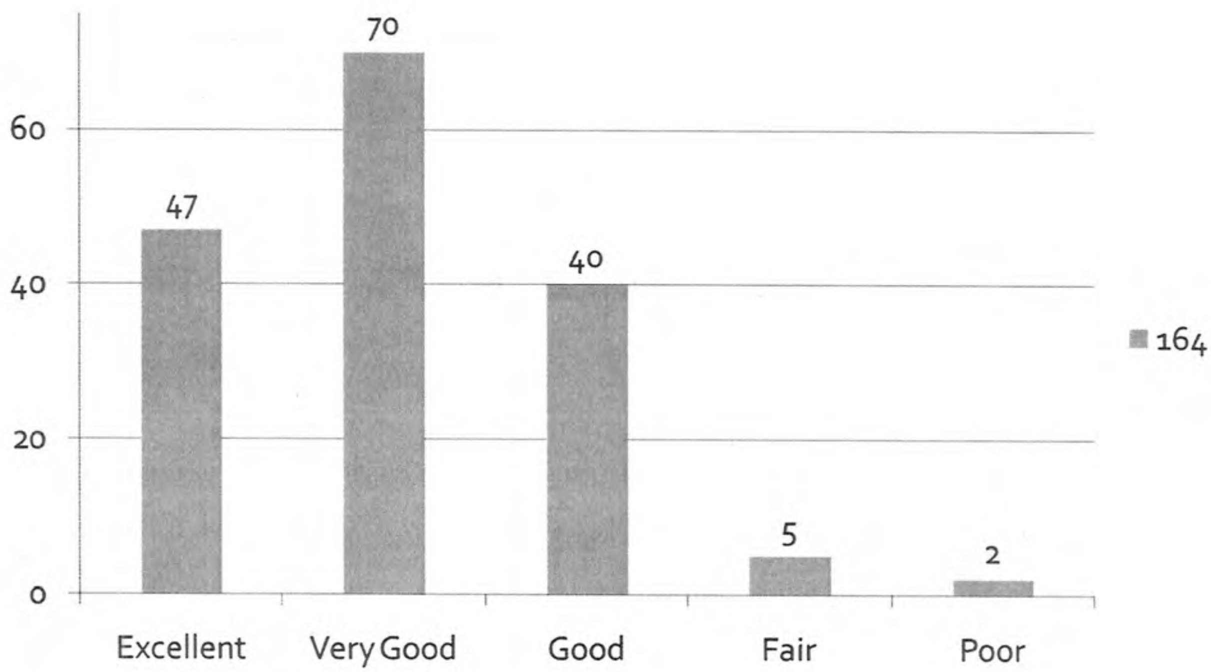


Figure 2

Rate the effectiveness of how well the activity related to your practice needs

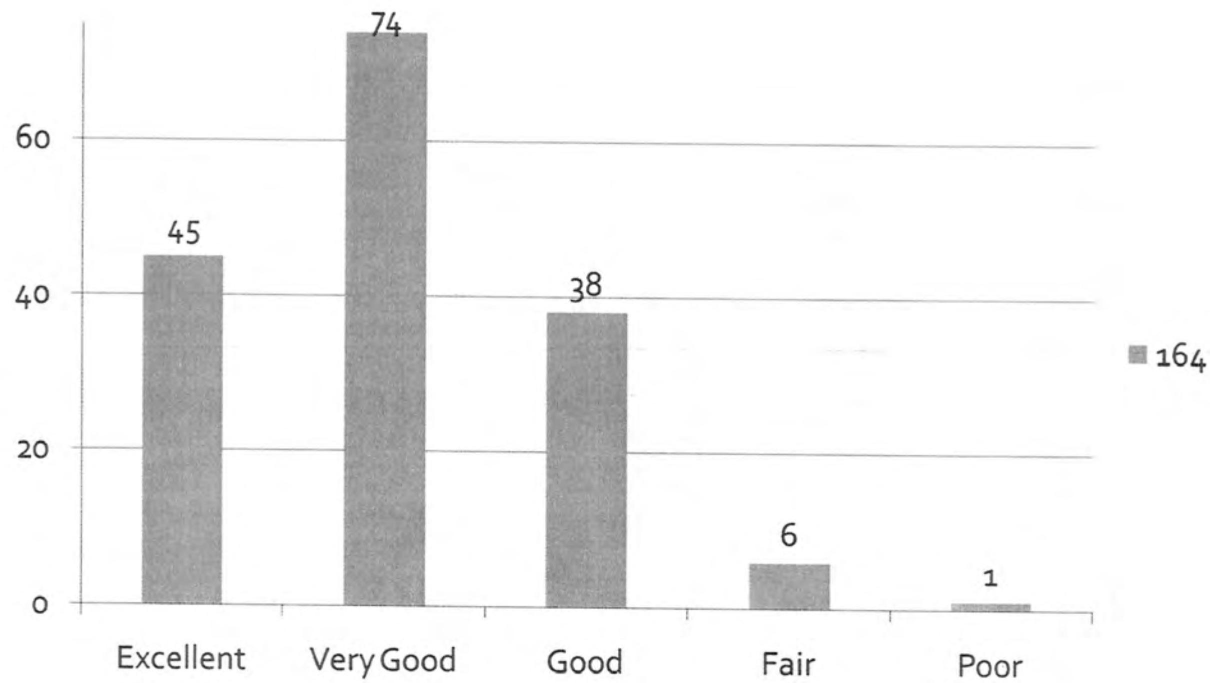


Figure 3

Rate the effectiveness of how well the activity will help you improve patient care

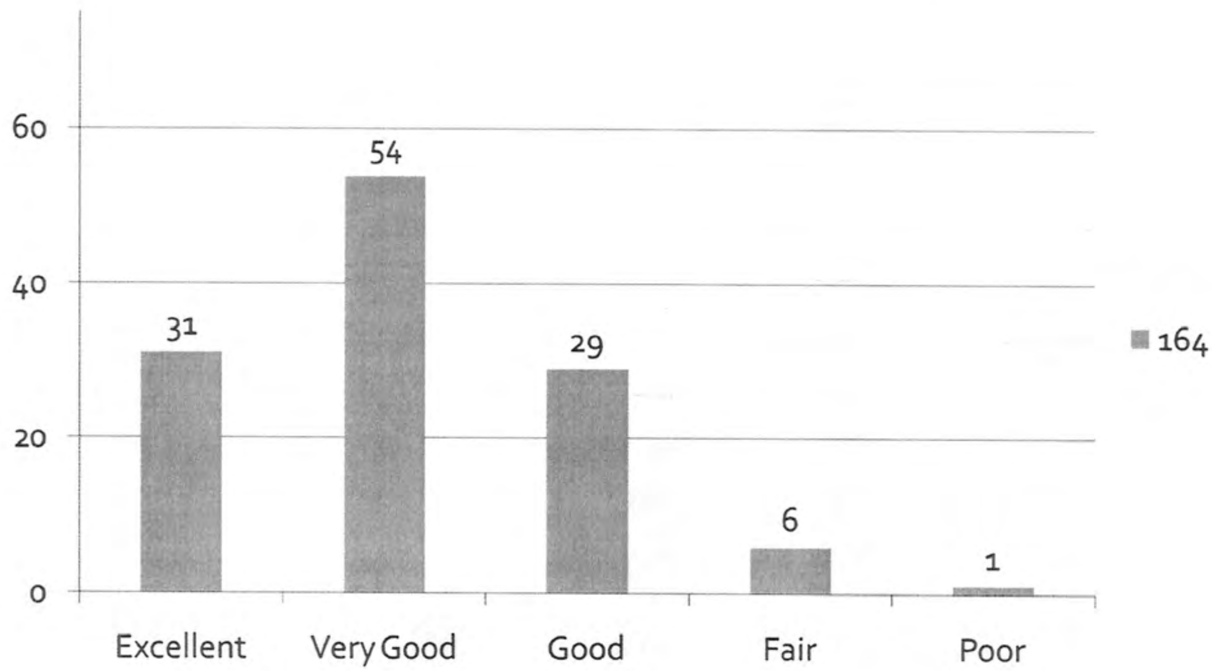


Figure 4

Rate the effectiveness of how well the instructor conveyed the subject matter

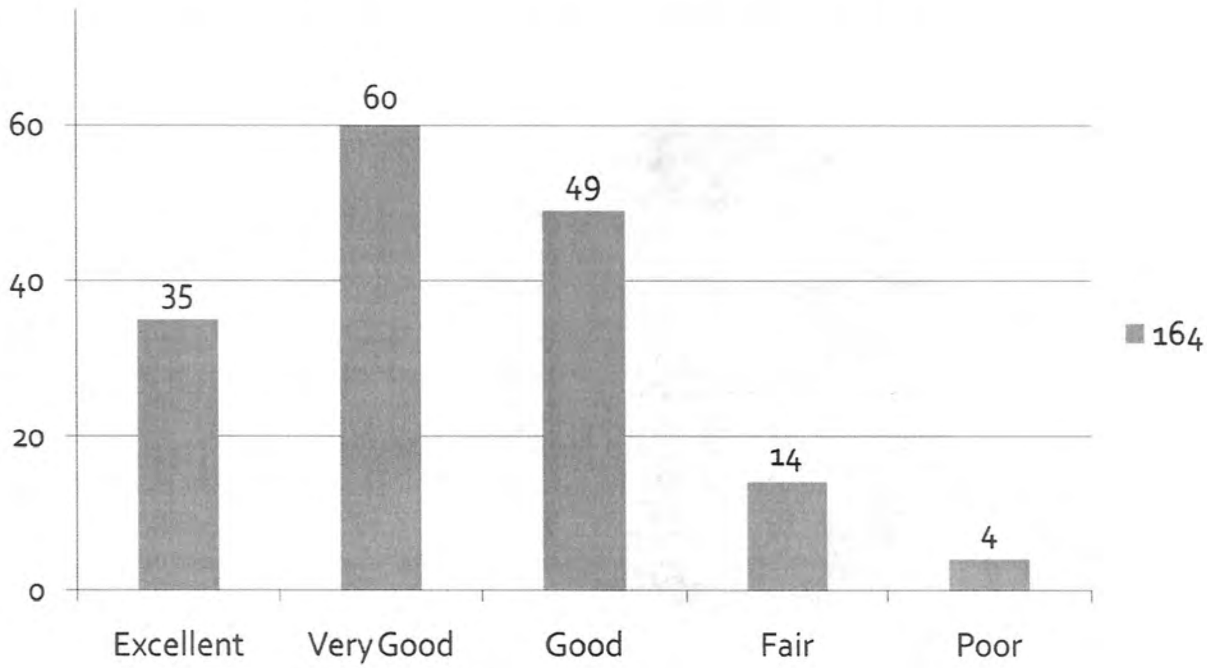


Figure 5

As a result of the activity, did you learn something new or verify information you already knew?

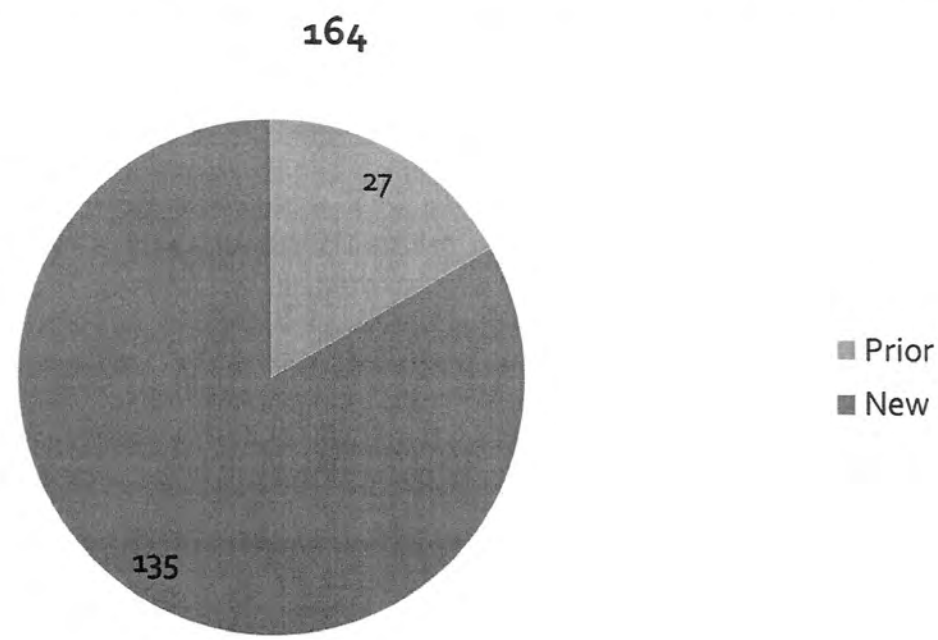


Figure 6

Would you participate in a future web cast?

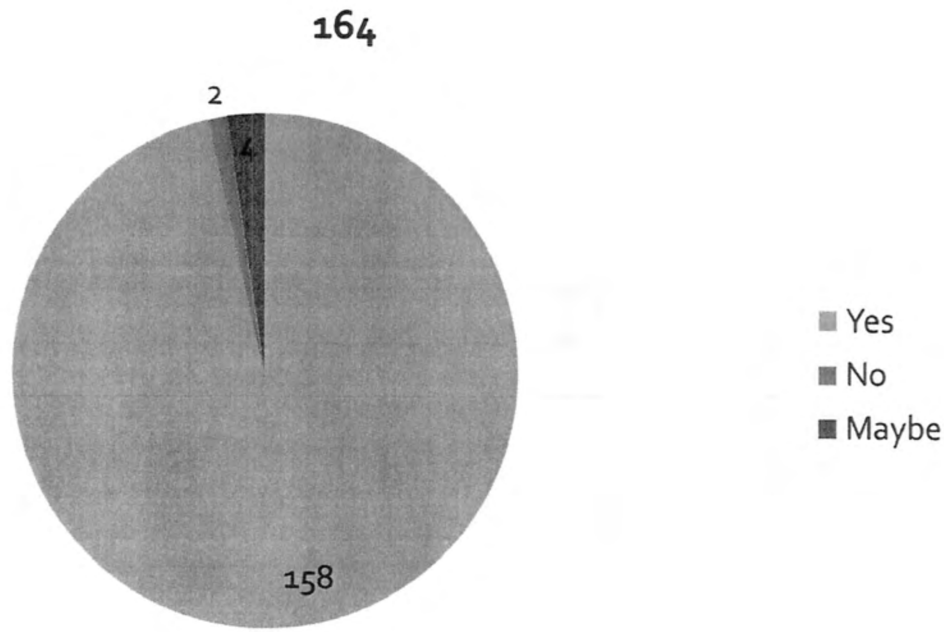


Figure 7

Rate the effectiveness of how well the activity met the stated learning objectives

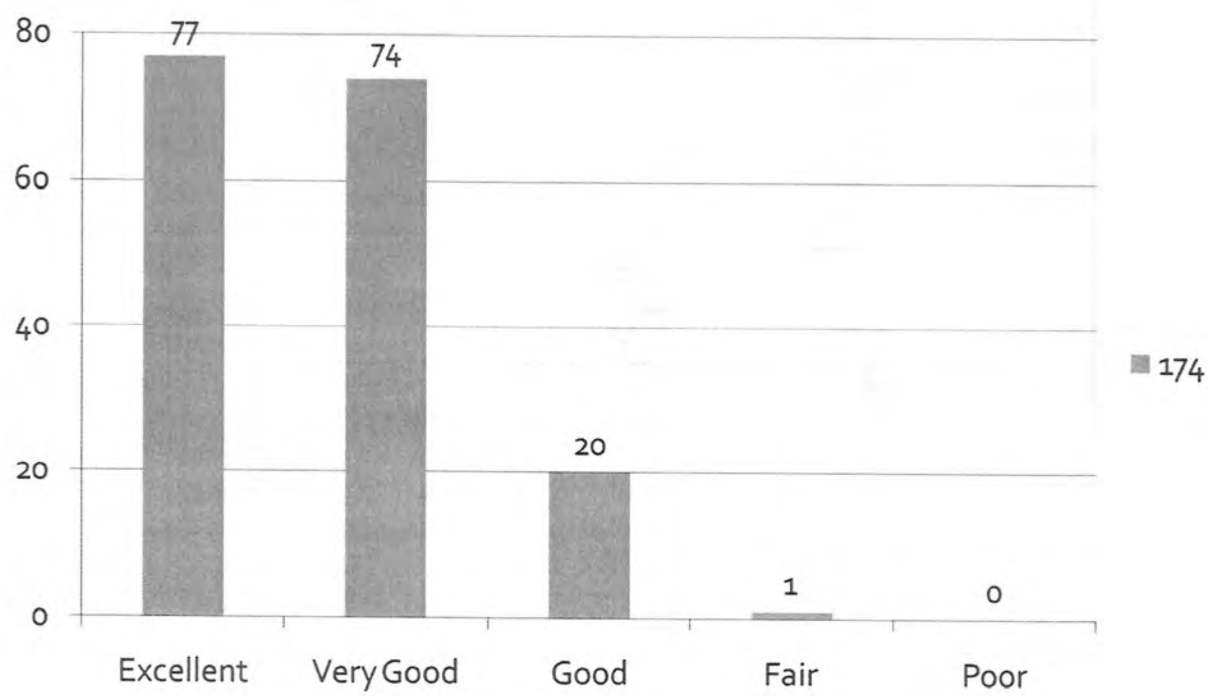


Figure 8

Rate the effectiveness of how well the activity related to your practice needs

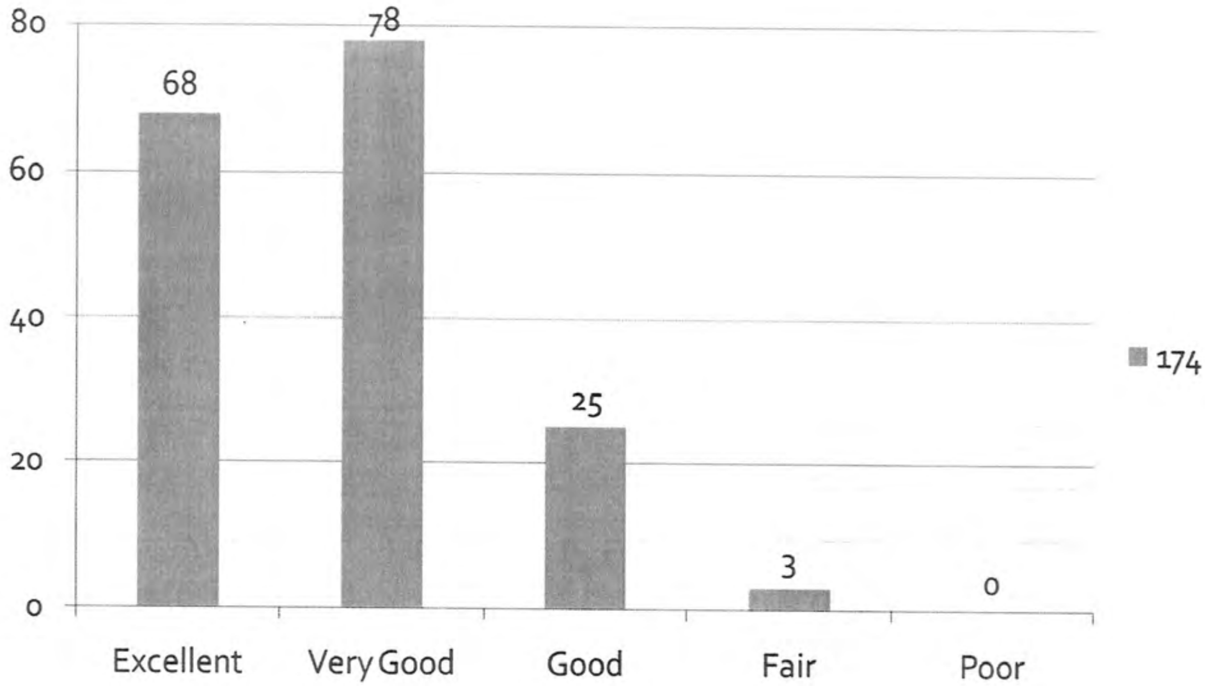


Figure 9

Rate the effectiveness of how well the activity will help you improve patient care

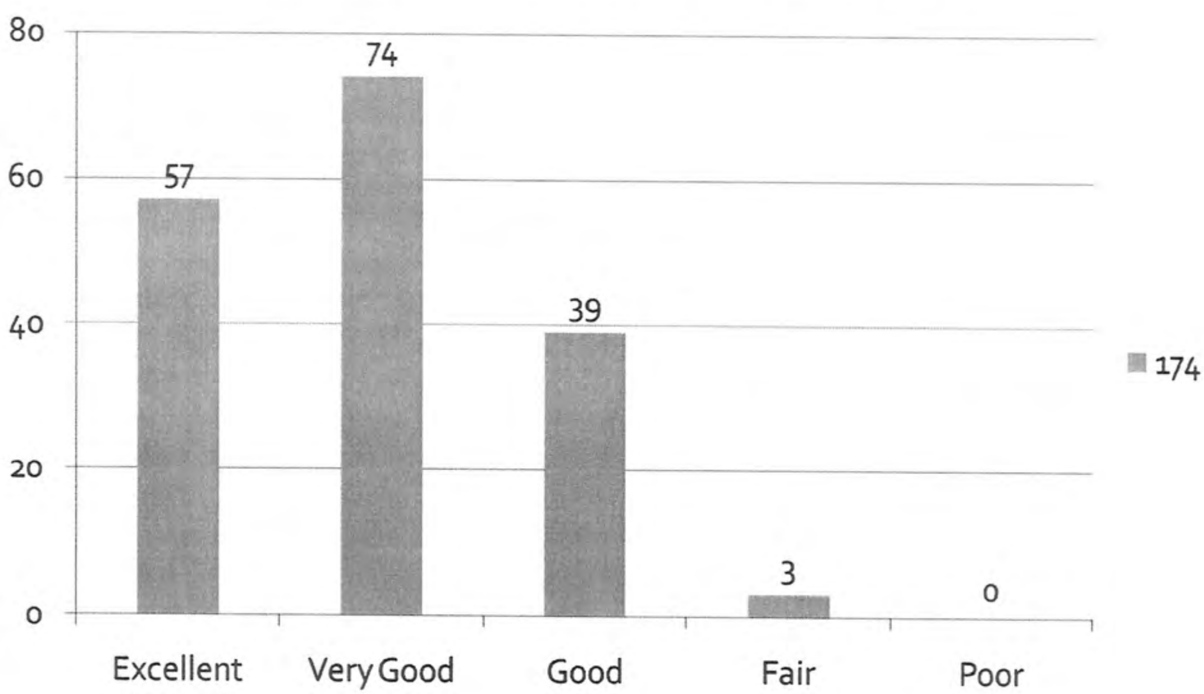


Figure 10

Rate the effectiveness of how well the instructor conveyed the subject matter

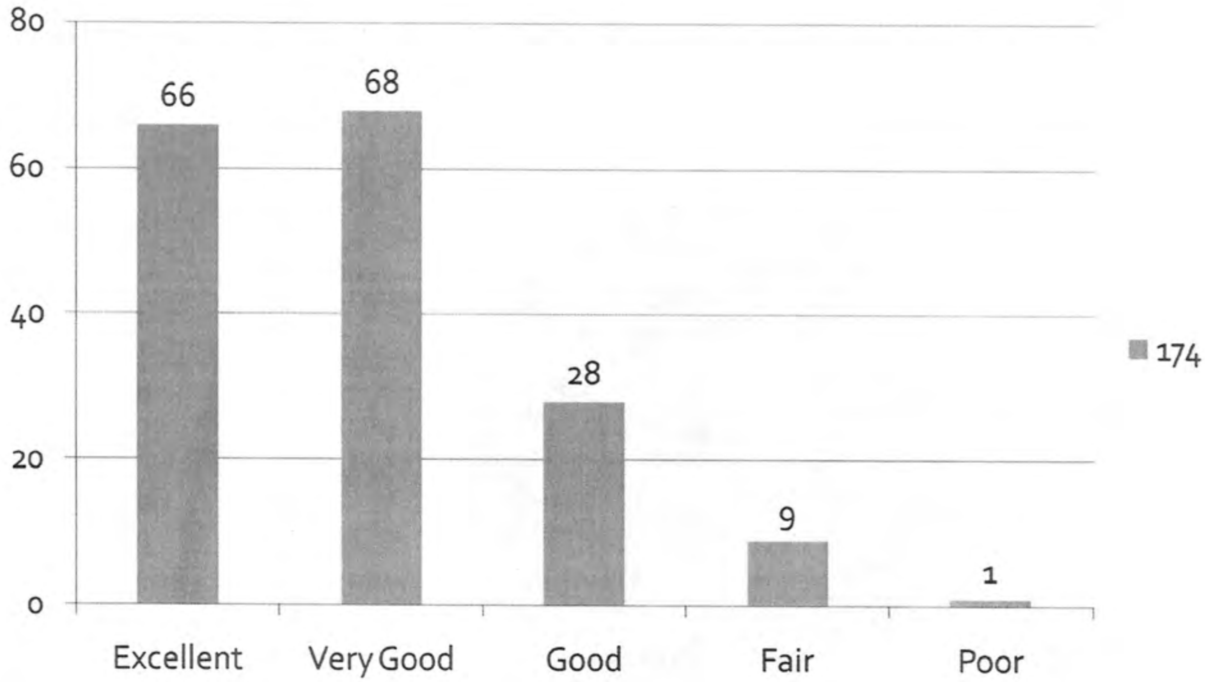


Figure 11

As a result of the activity, did you learn something new or verify information you already knew?

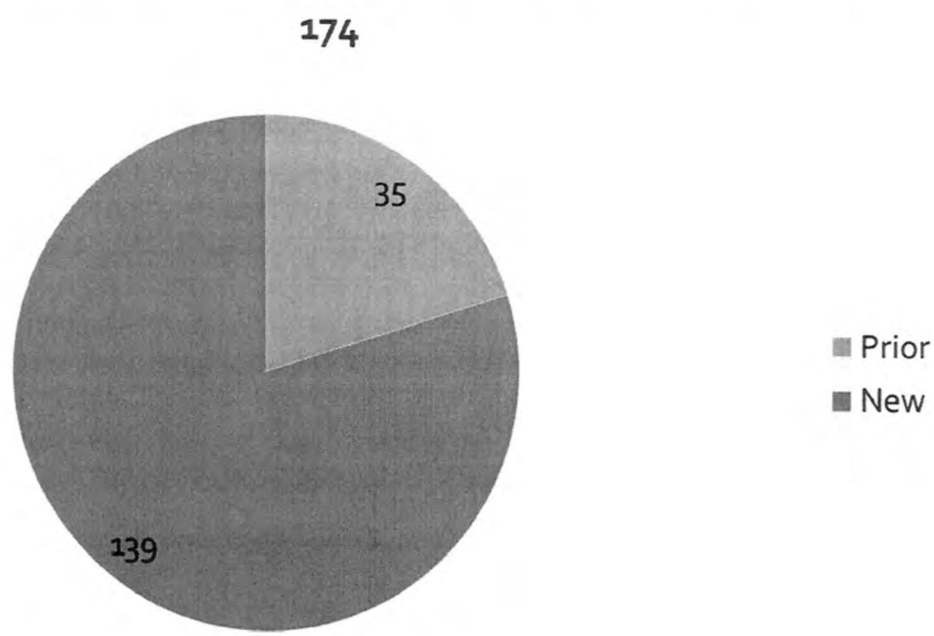
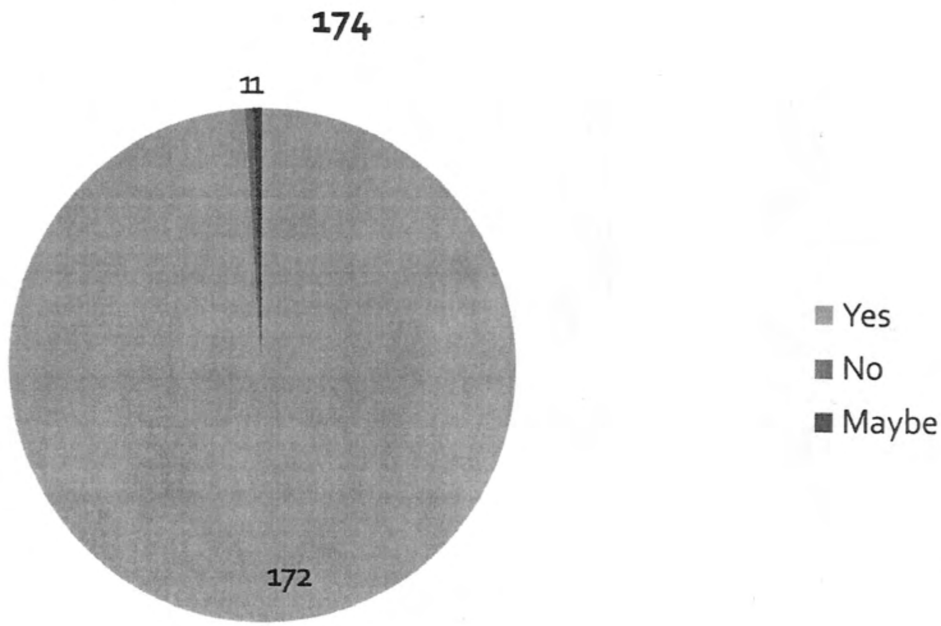


Figure 12

Would you participate in a future web cast?



(5/2) Asthma - The Challenge of Children, Minorities, and Low-income Population

Figure 13

Rate objective 1: To define the highest risk asthma populations

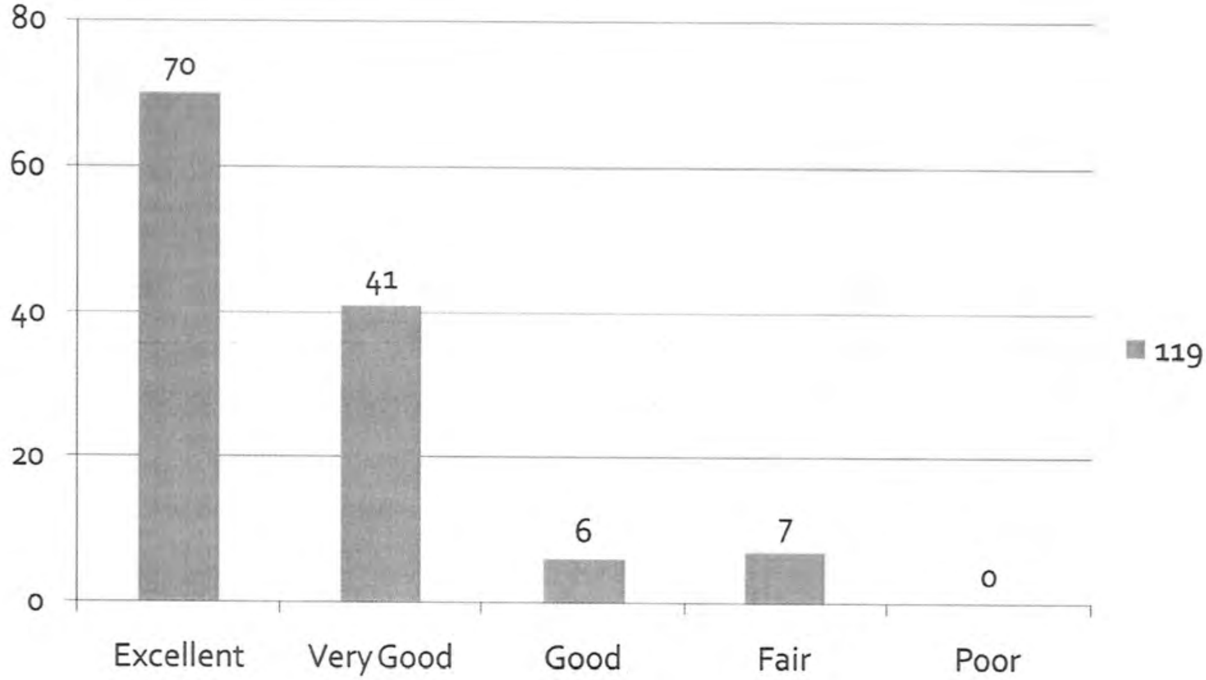


Figure 14

Rate objective 2: To outline the significant features of the asthma management guidelines

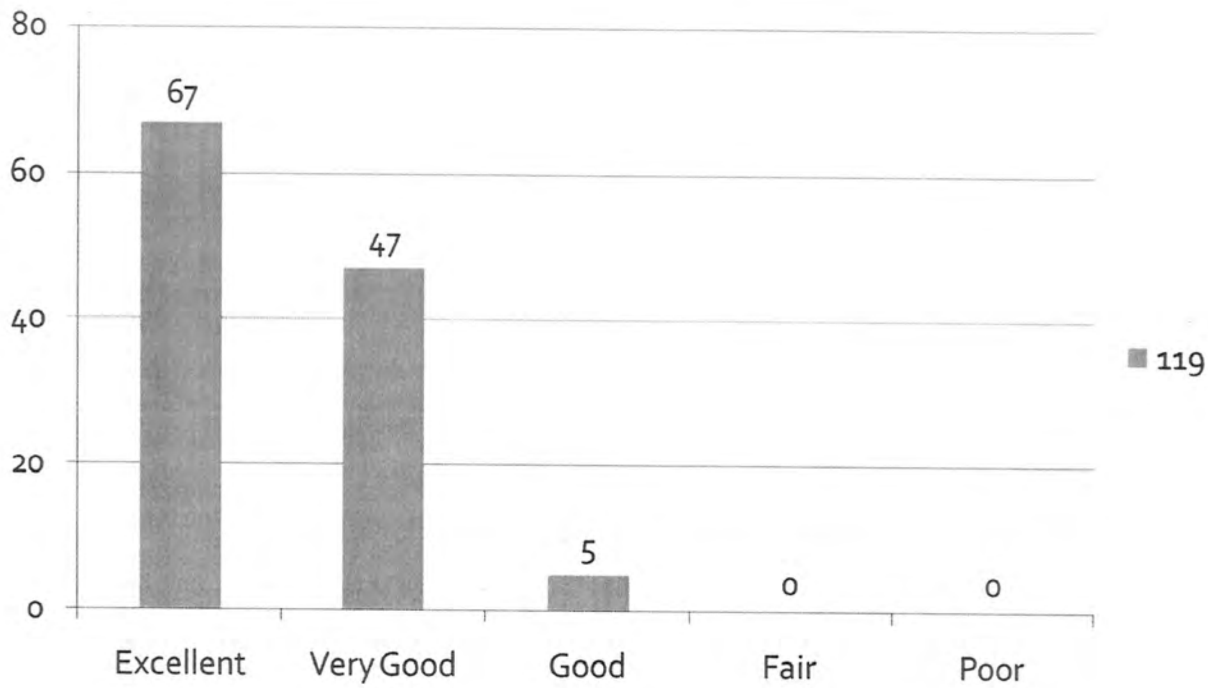


Figure 15

Rate objective 3: To describe adherence issues and methods to overcome difficulties

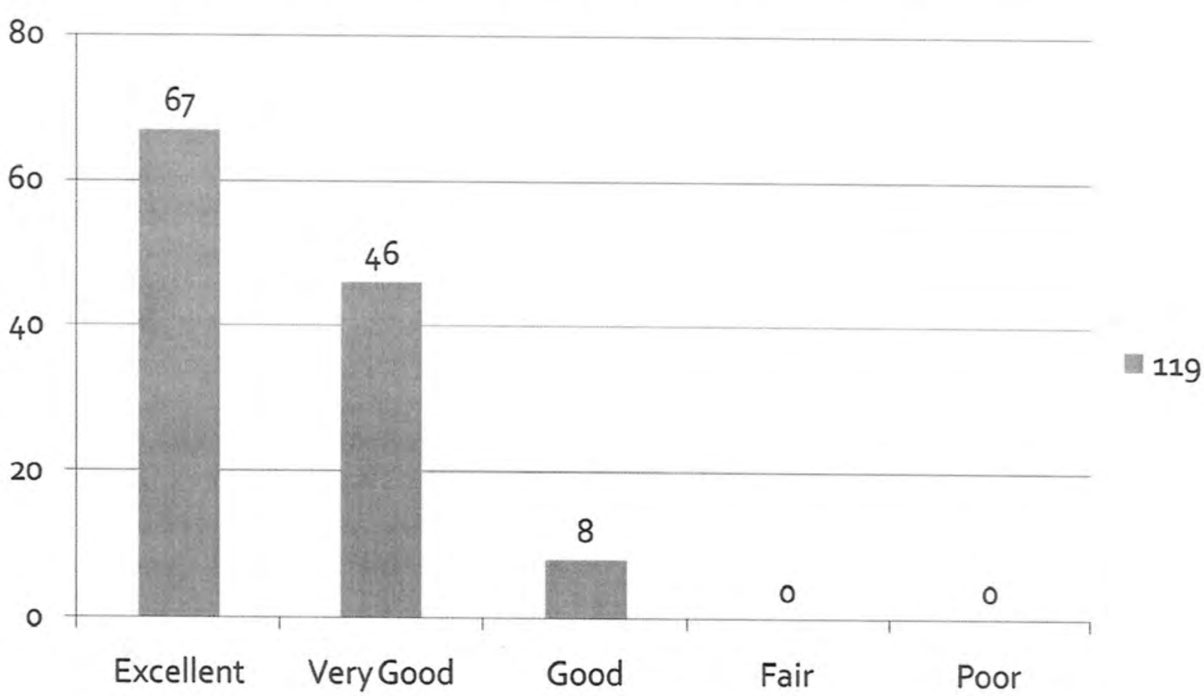


Figure 16

Rate objective 4: To specify new advances in the diagnosis and pharmacological treatment of asthma

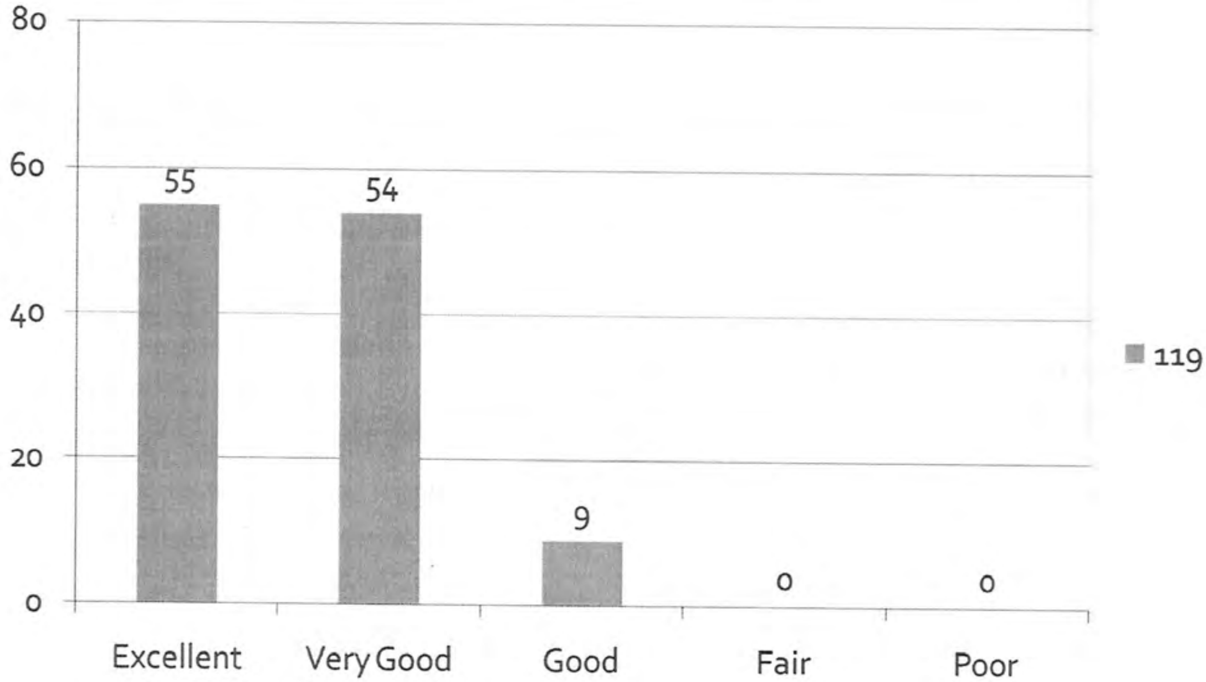


Figure 17

What is your overall evaluation of the CE activity?

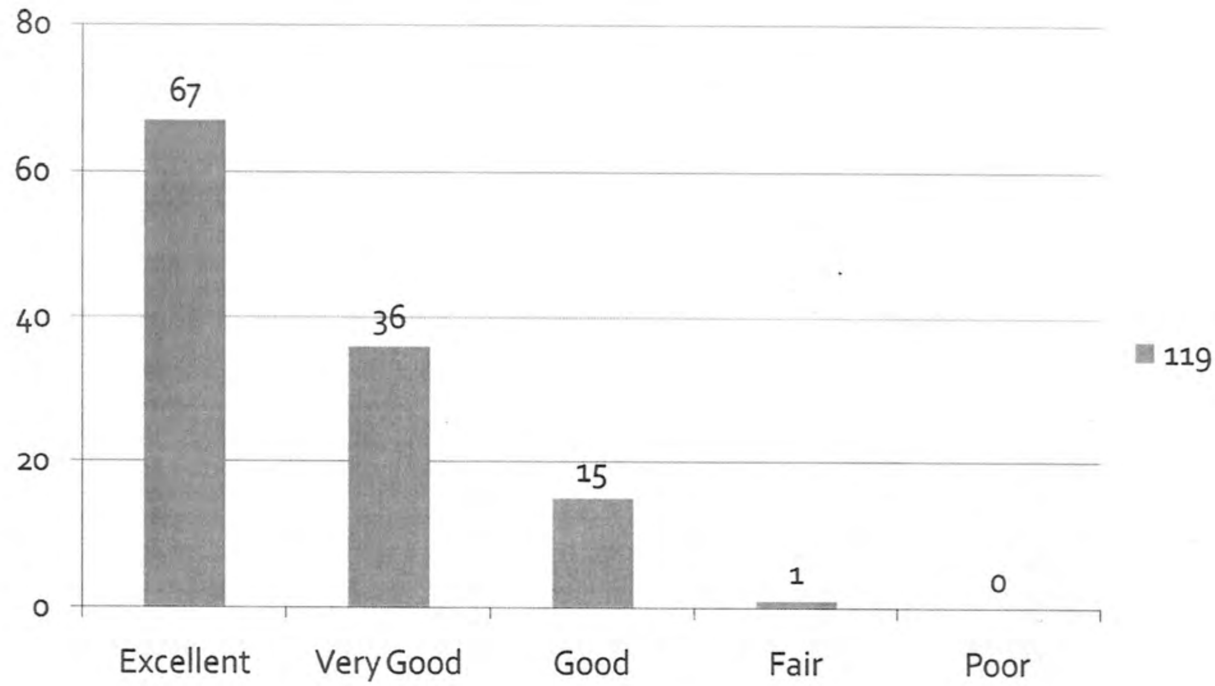


Figure 18

Did this CE activity meet the objectives?

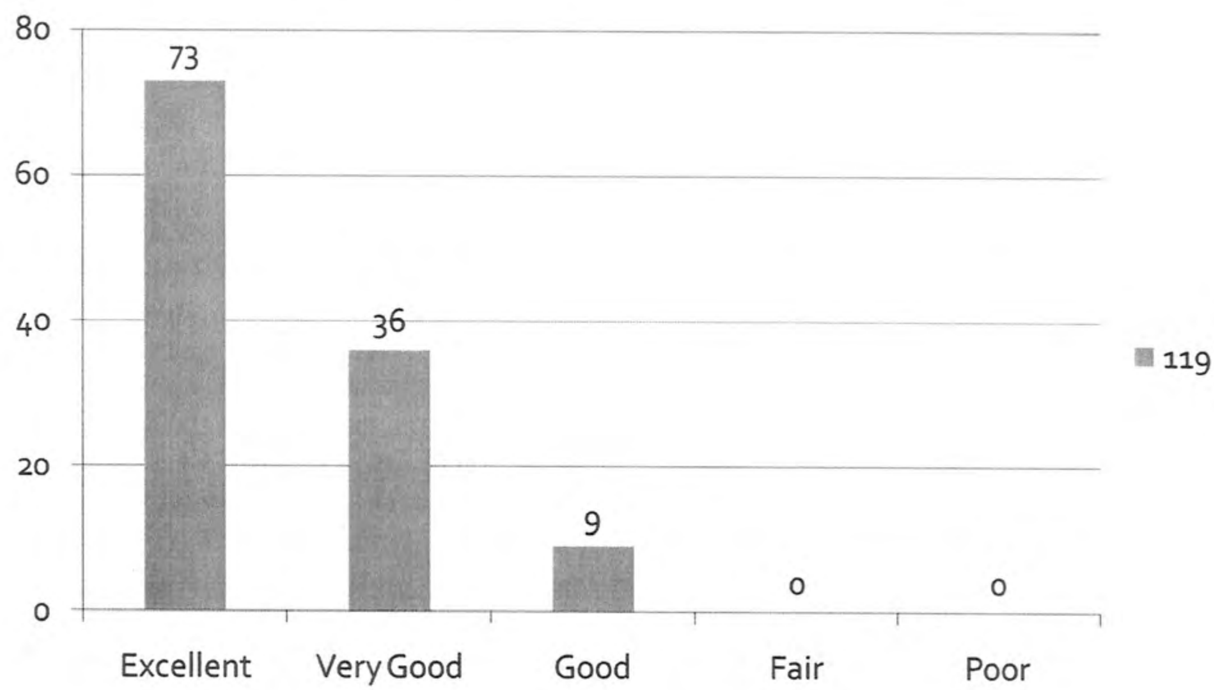


Figure 19

What is your overall evaluation of the CE activity content?

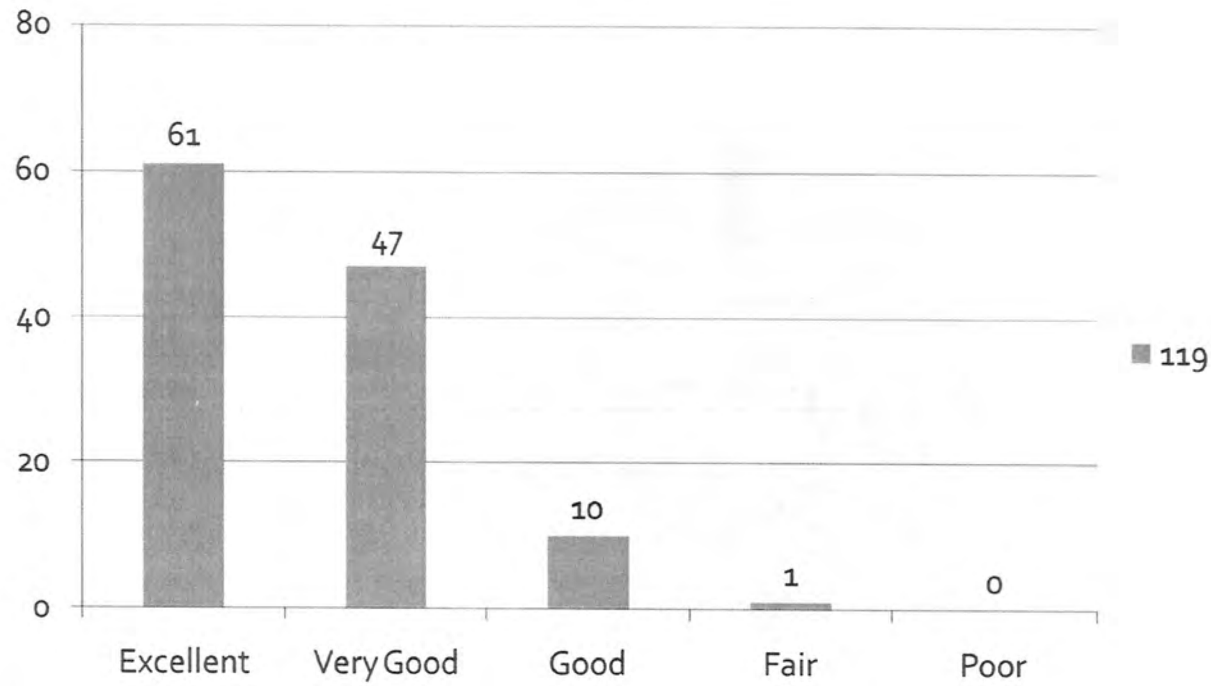


Figure 20

On a graded scale, did you perceive the presentation to be commercial or educational?

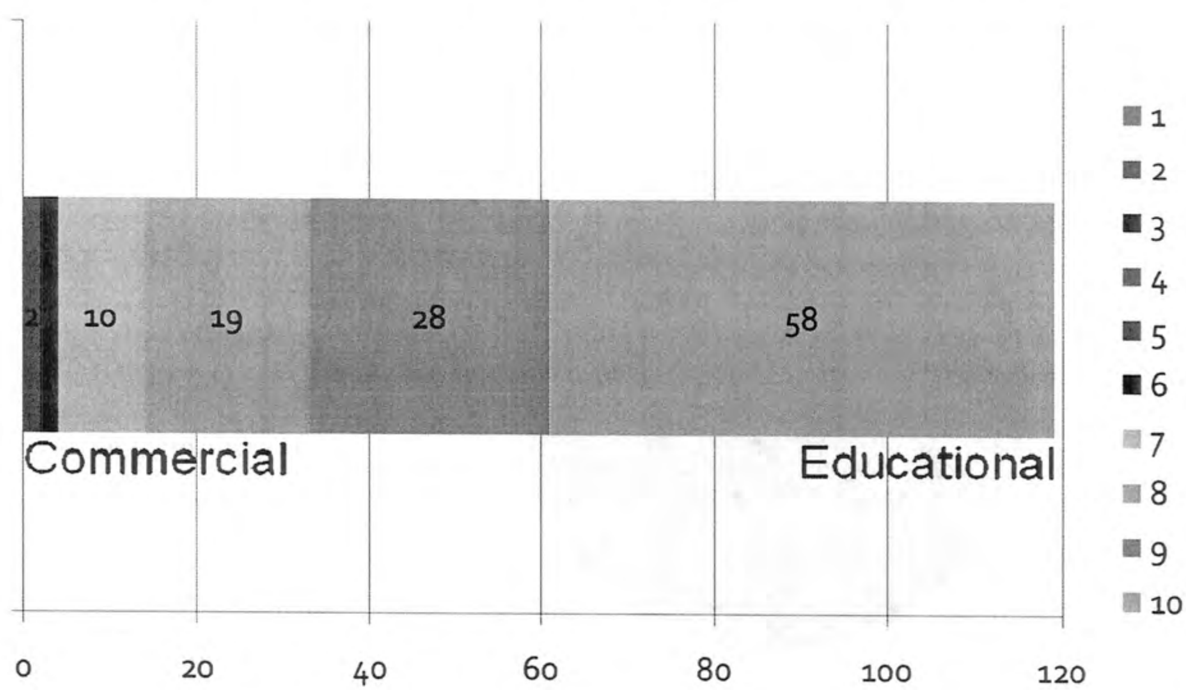


Figure 21

Have you participated in a web cast before?

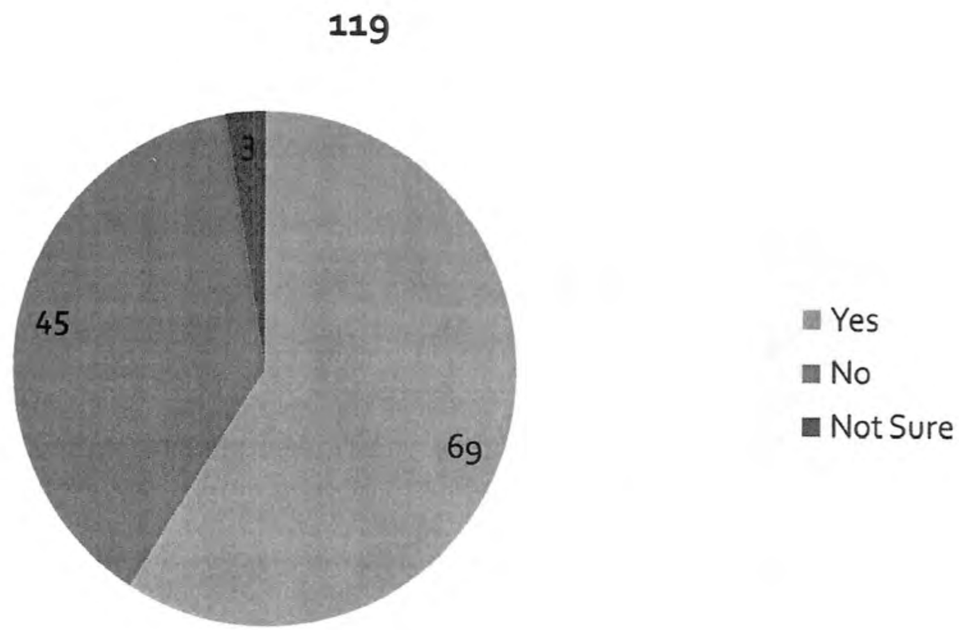


Figure 22

How did you find out about this webcast?

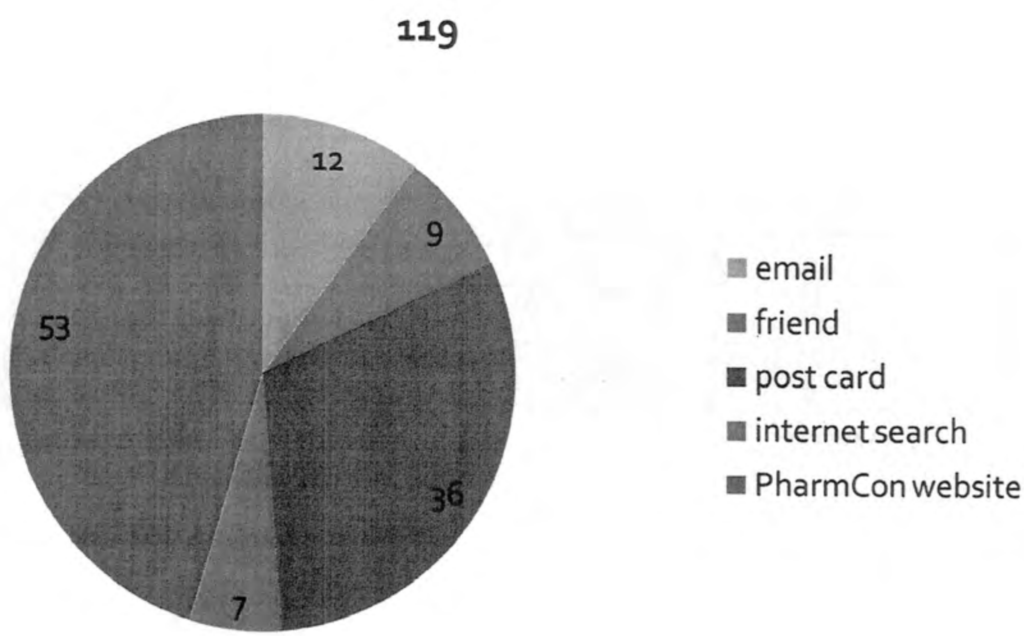
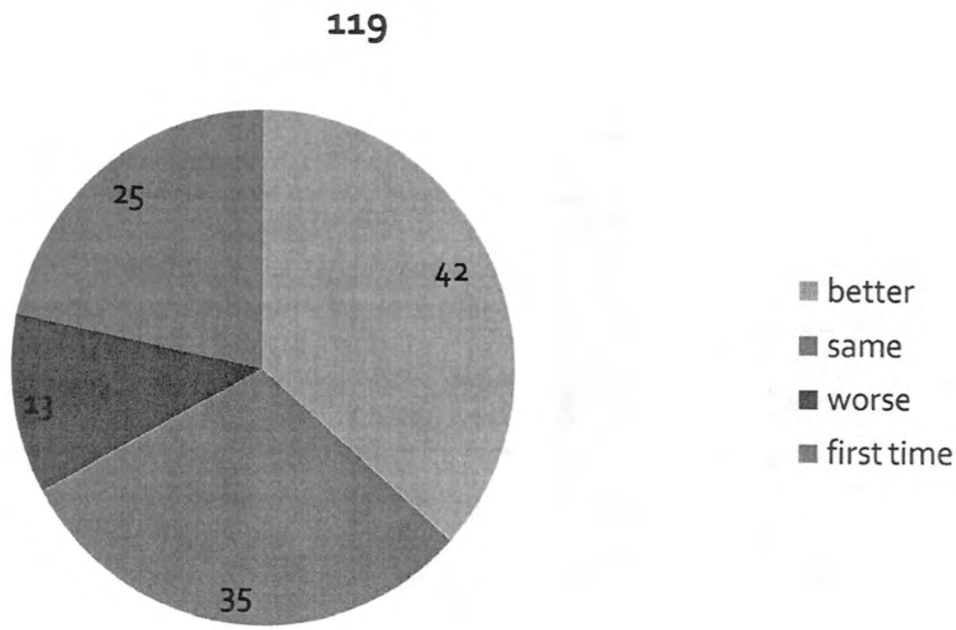


Figure 23

How would you rate the "ease of use" of this web cast as compared to other webcasts?



<u>(4/11/07) The Pharmacists' Role in Treating Hypertension</u>

Figure 24

Rate the effectiveness of how well the activity related to your practice needs

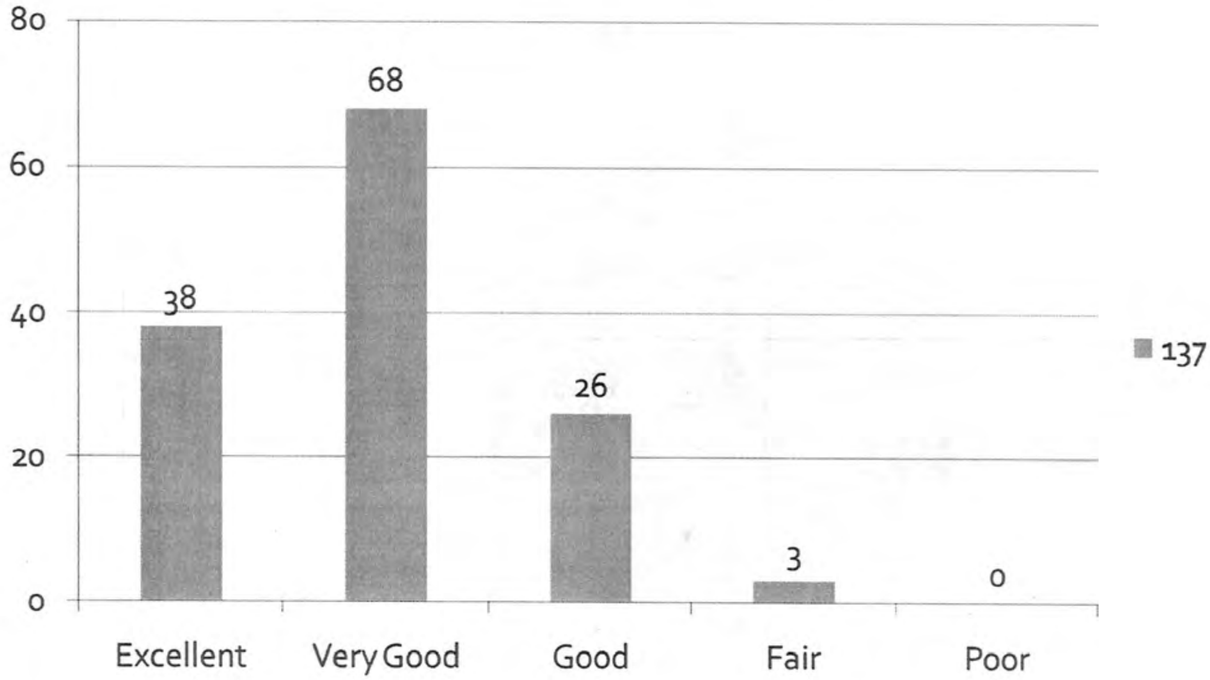


Figure 25

Rate the effectiveness of how well the activity will help you improve patient care

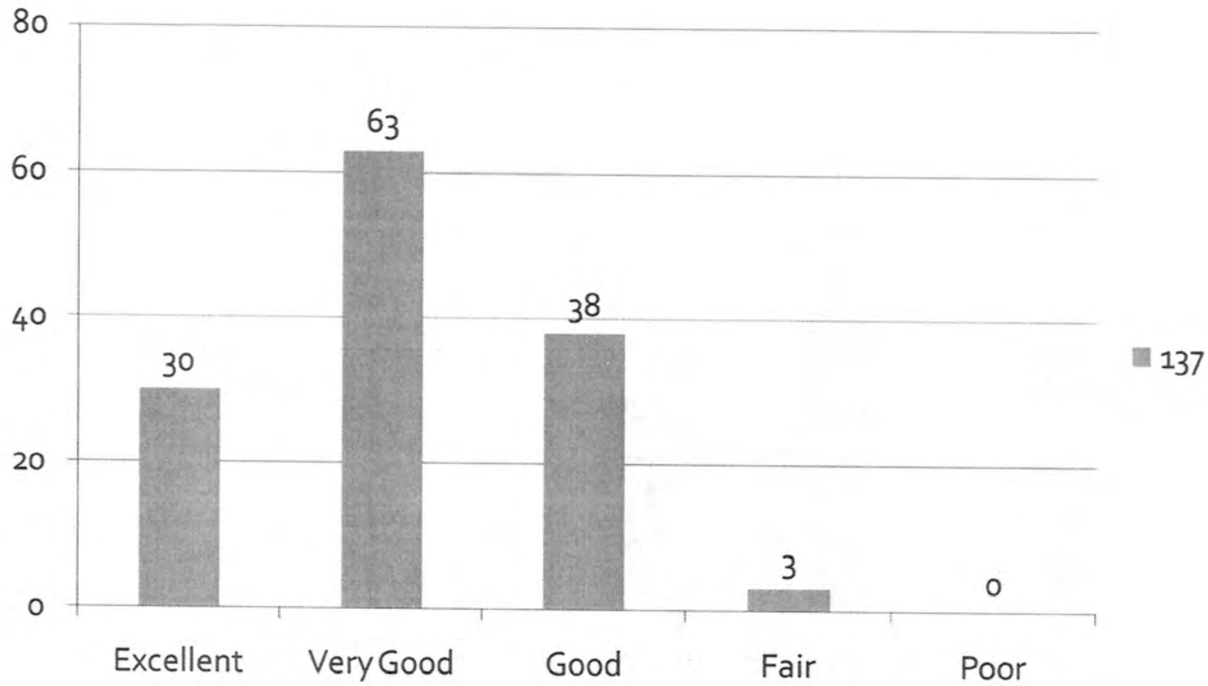


Figure 26

Rate the effectiveness of how well the instructor conveyed the subject matter

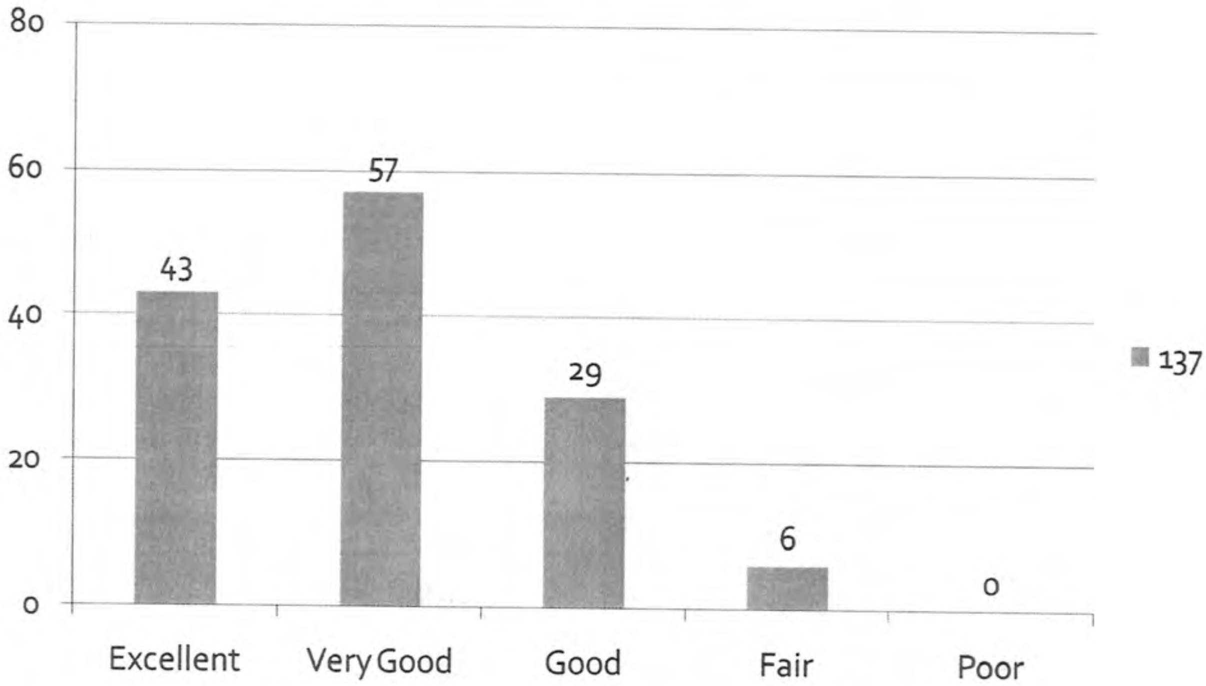


Figure 27

As a result of the activity, did you learn something new or verify information you already knew?

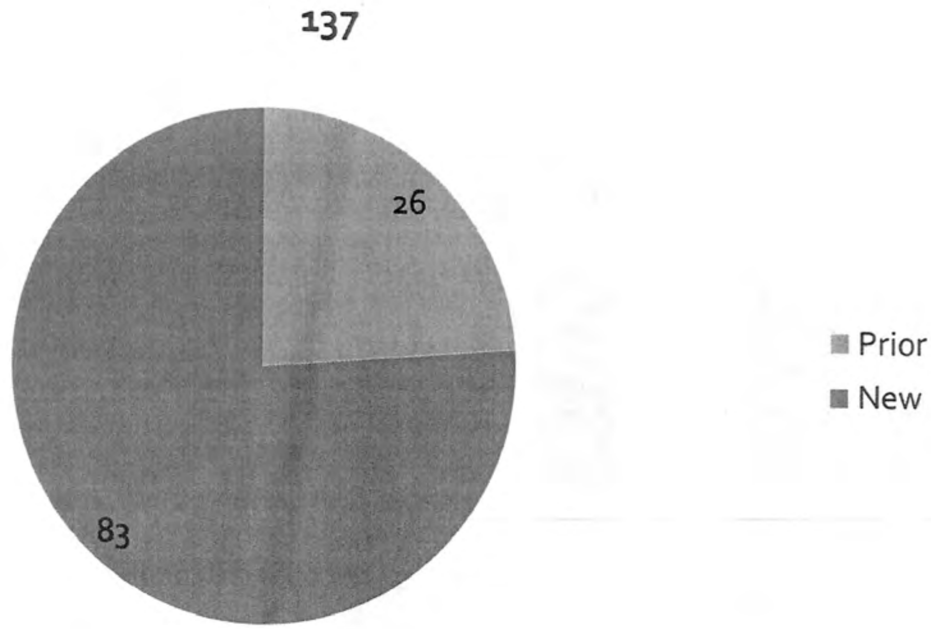
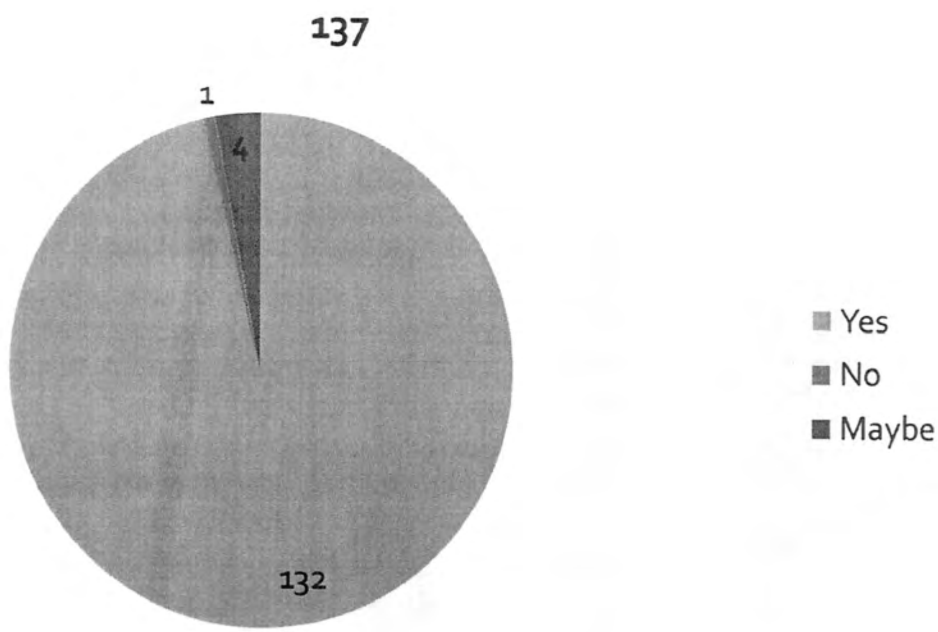


Figure 28

Would you participate in a future web cast?



(5/9/07) The Pharmacists' Role in Treating Hypertension

Figure 29

Rate objective 1: Enhance your understanding of hypertension to include cardiovascular risks, management, and goals for individual patients.

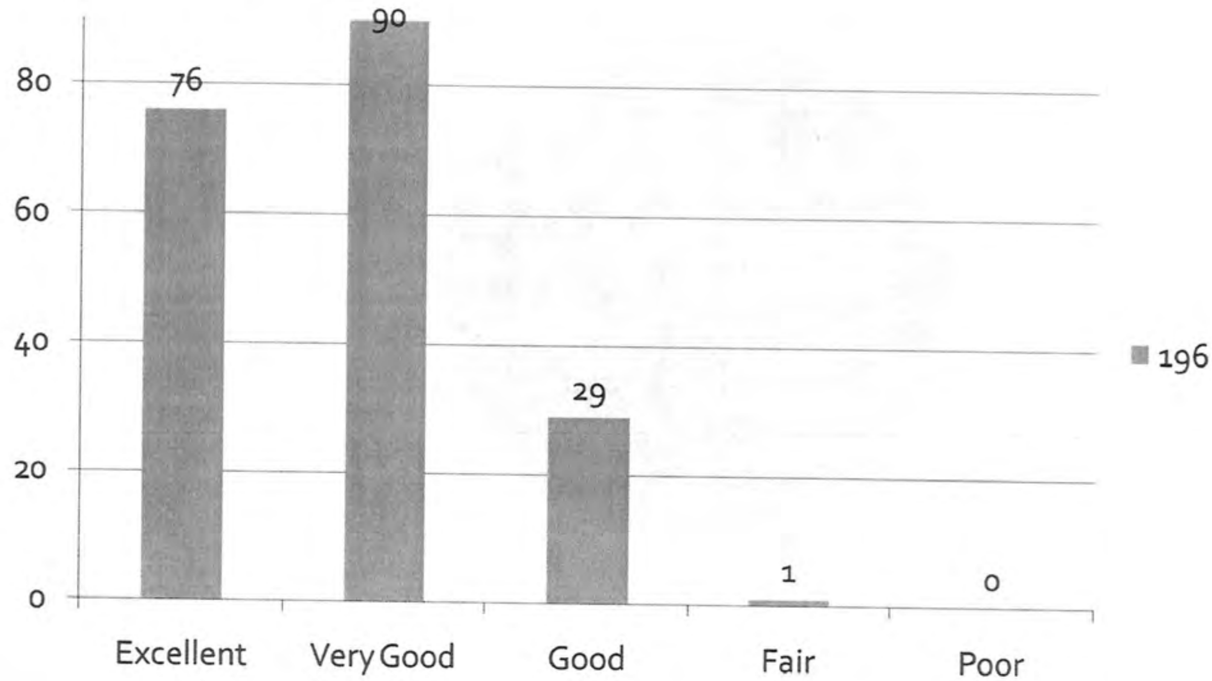


Figure 30

Rate objective 2: Review and discuss the current pharmacotherapy standards of care for hypertension.

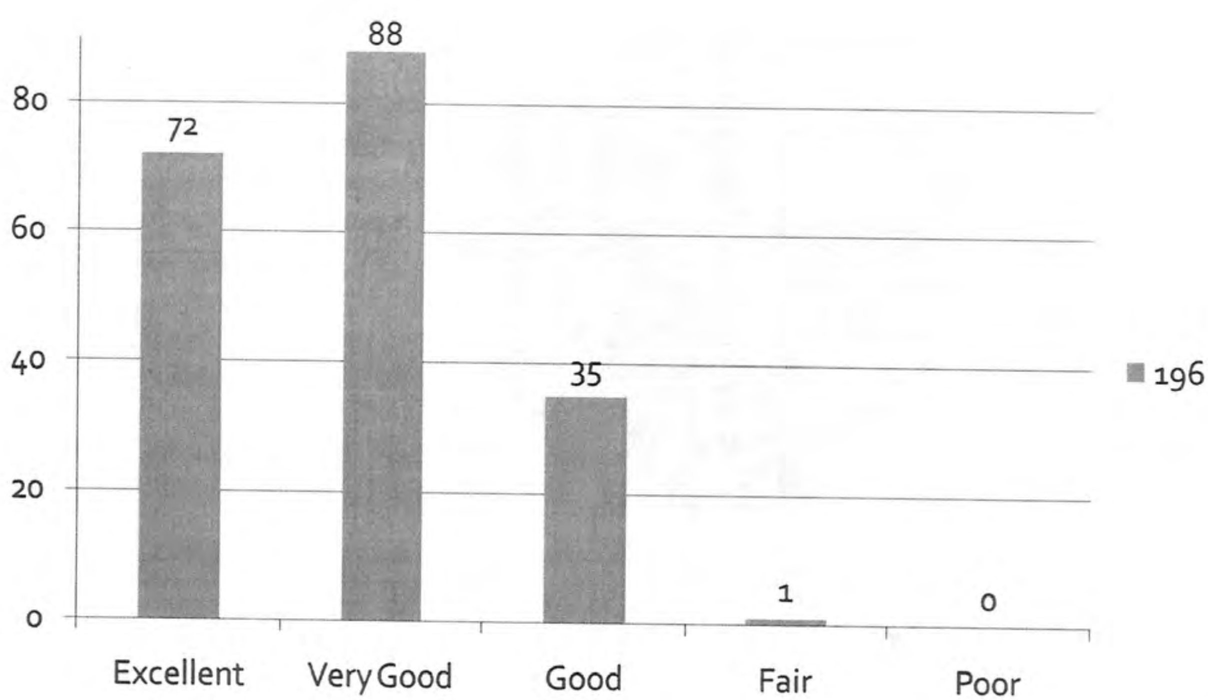


Figure 31

Rate objective 3: Describe the pharmacist's role in counseling patients on hypertensive medications.

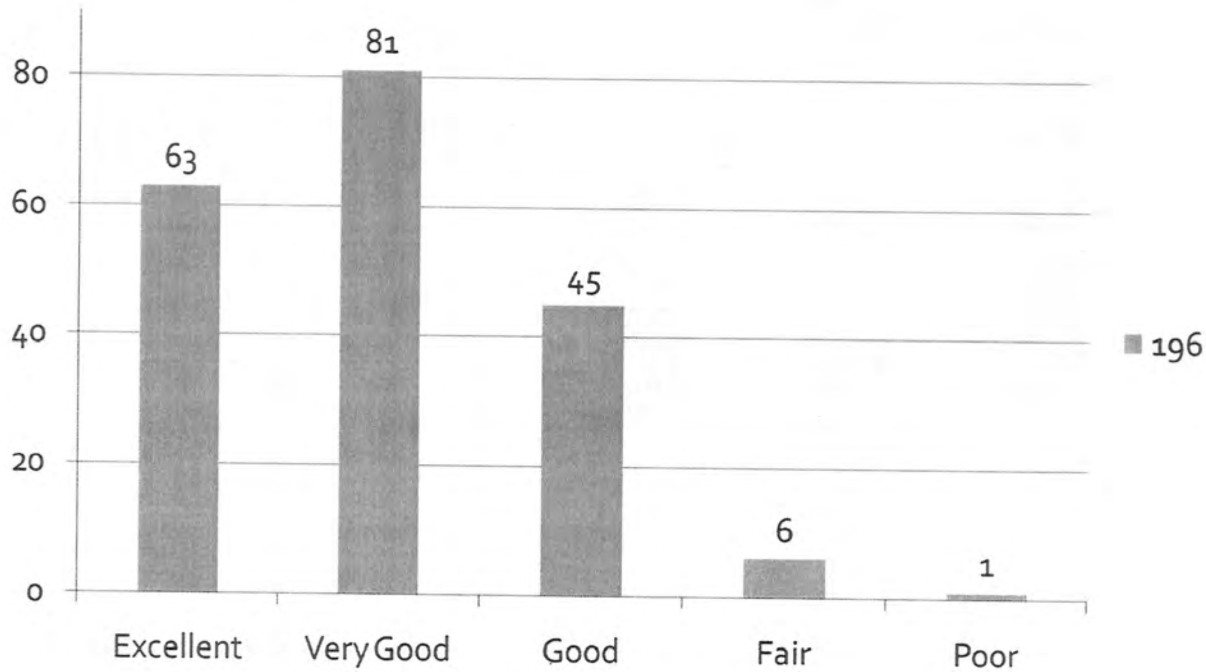


Figure 32

What is your overall evaluation of the CE activity?

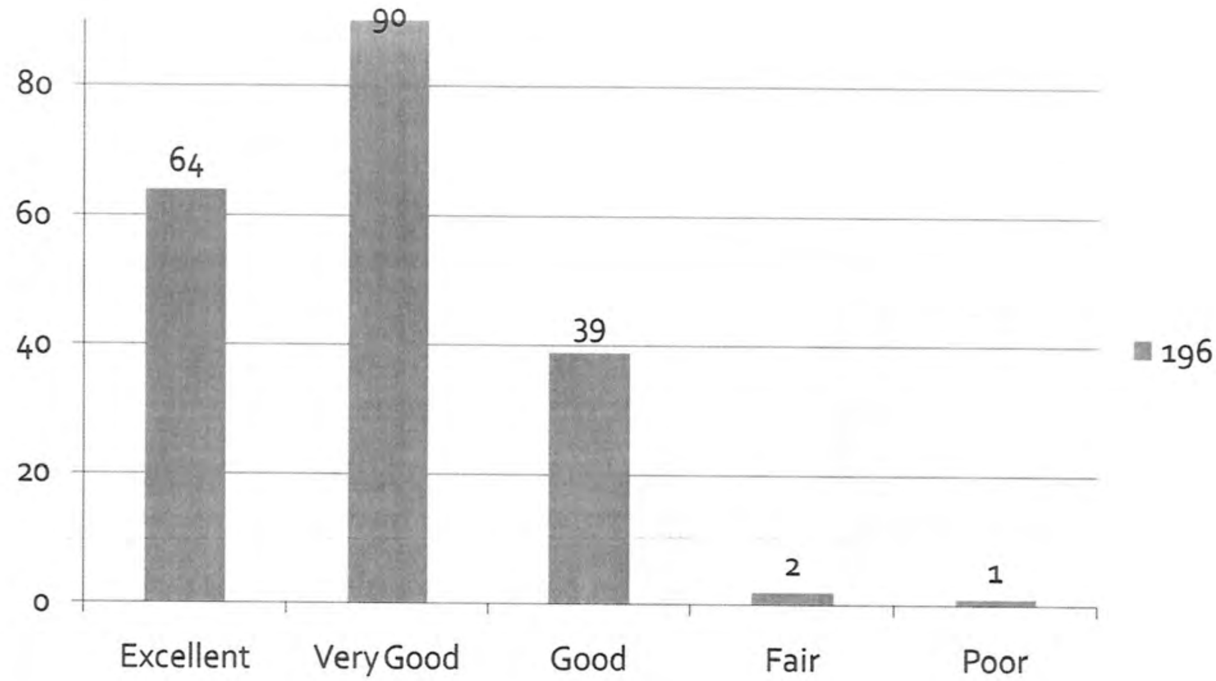


Figure 33

Did this CE activity meet the objectives?

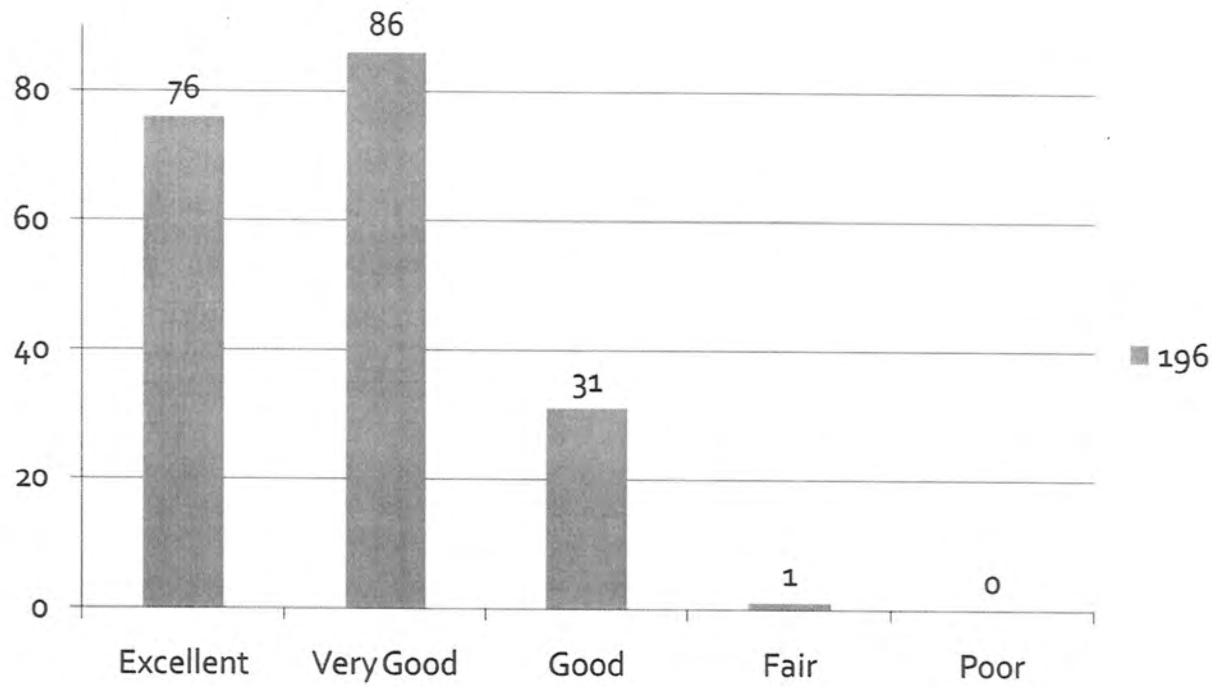


Figure 34

What is your overall evaluation of the CE activity content?

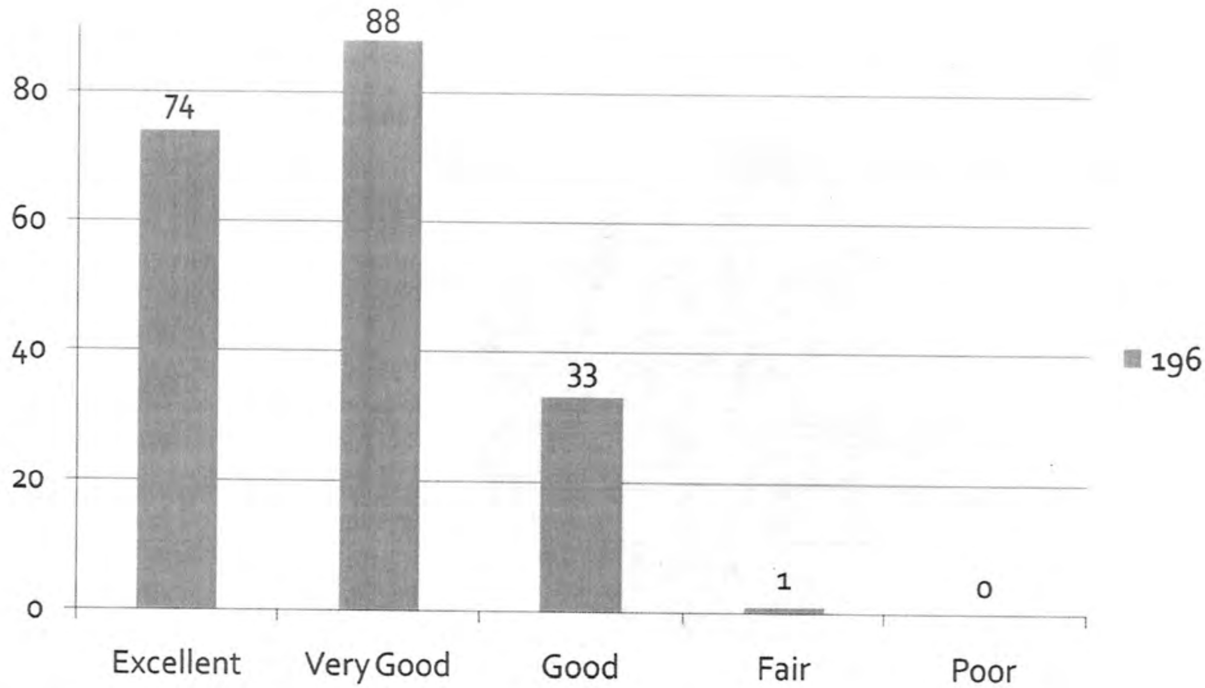


Figure 35

On a graded scale, did you perceive the presentation to be commercial or educational?

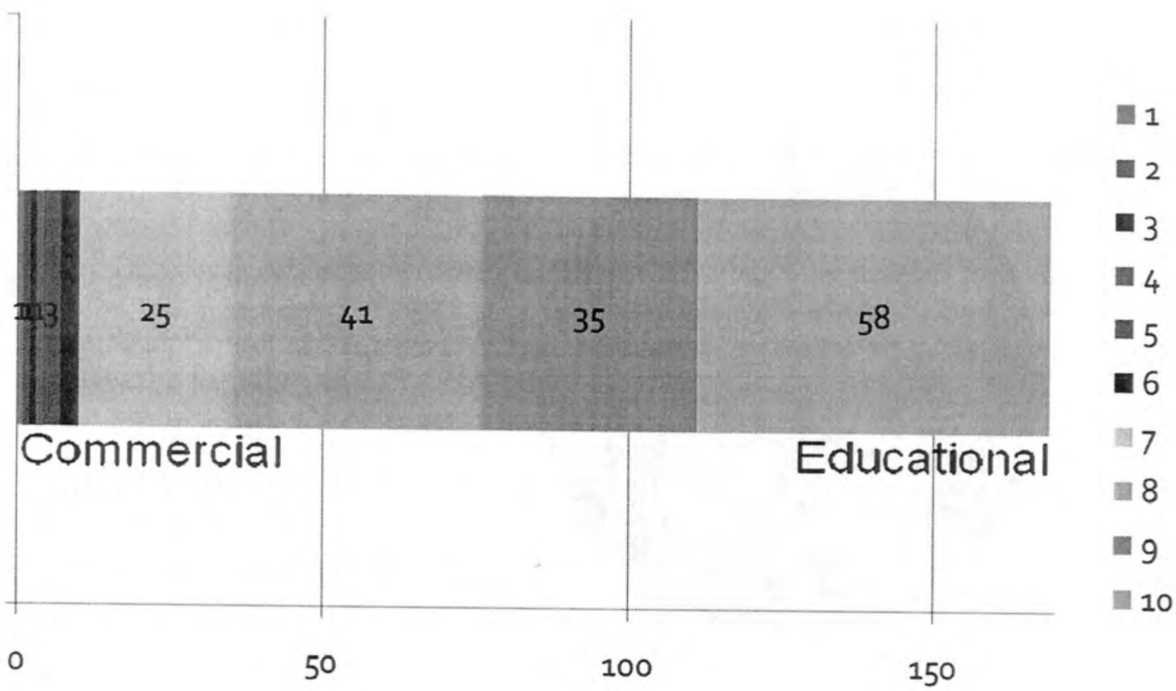


Figure 36

Have you participated in a web cast before?

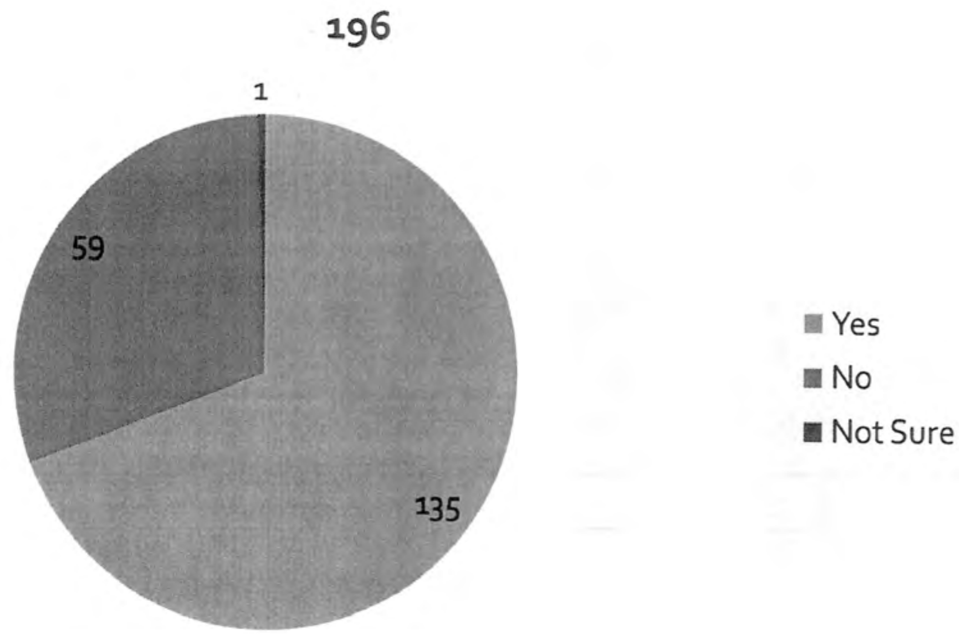


Figure 37

Which of the following is your preferred method to obtain your CE credits?

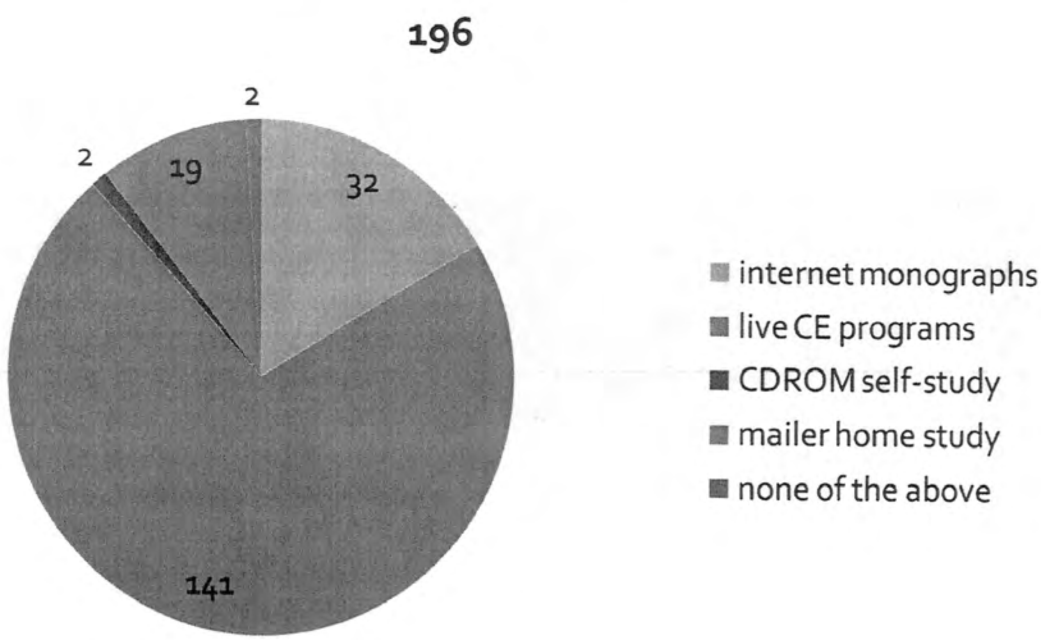
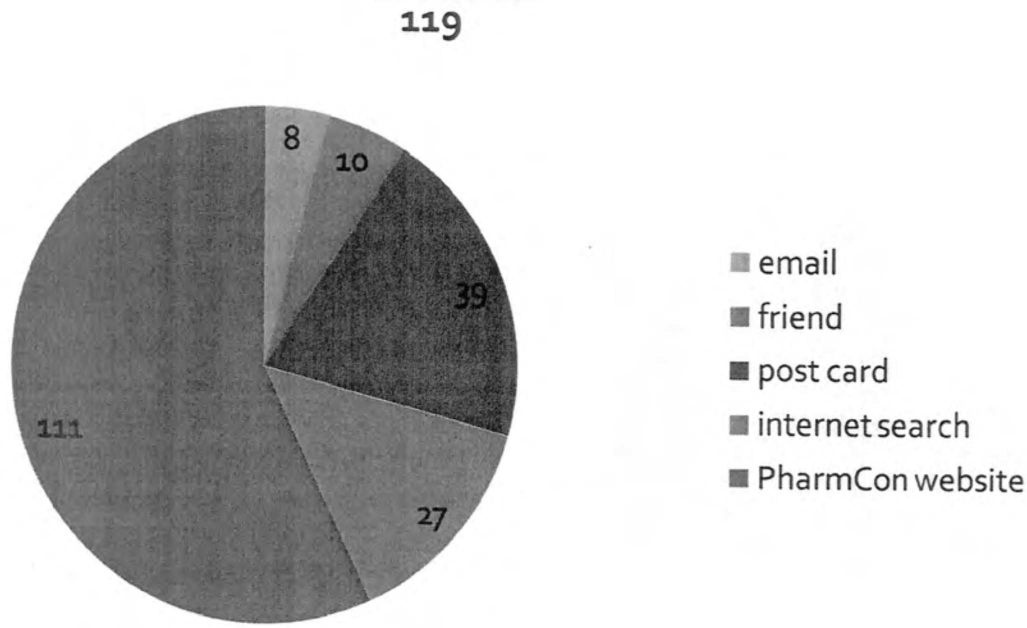


Figure 38

How did you find out about this webcast?



(6/6/07) Pharmacological Help for A Good Night's Sleep

Figure 39

Rate objective 1: Define insomnia and characterize the symptoms and array of causes.

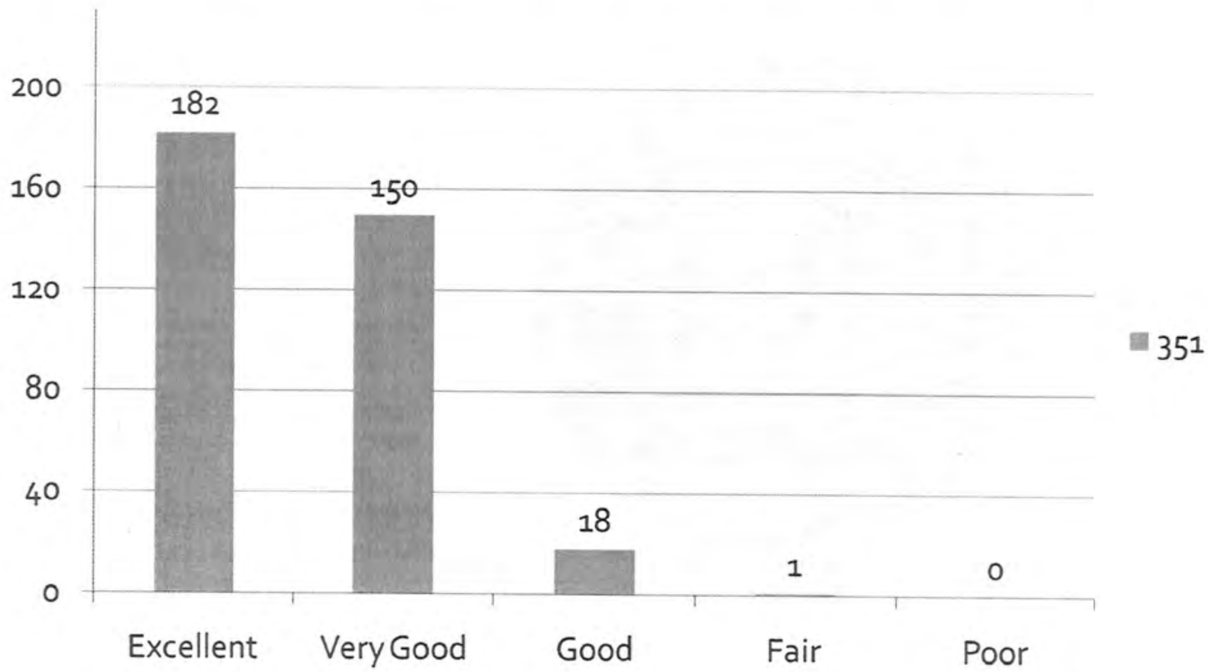


Figure 40

Rate objective 2: Describe traditional and new pharmacologic approaches to the management of insomnia.

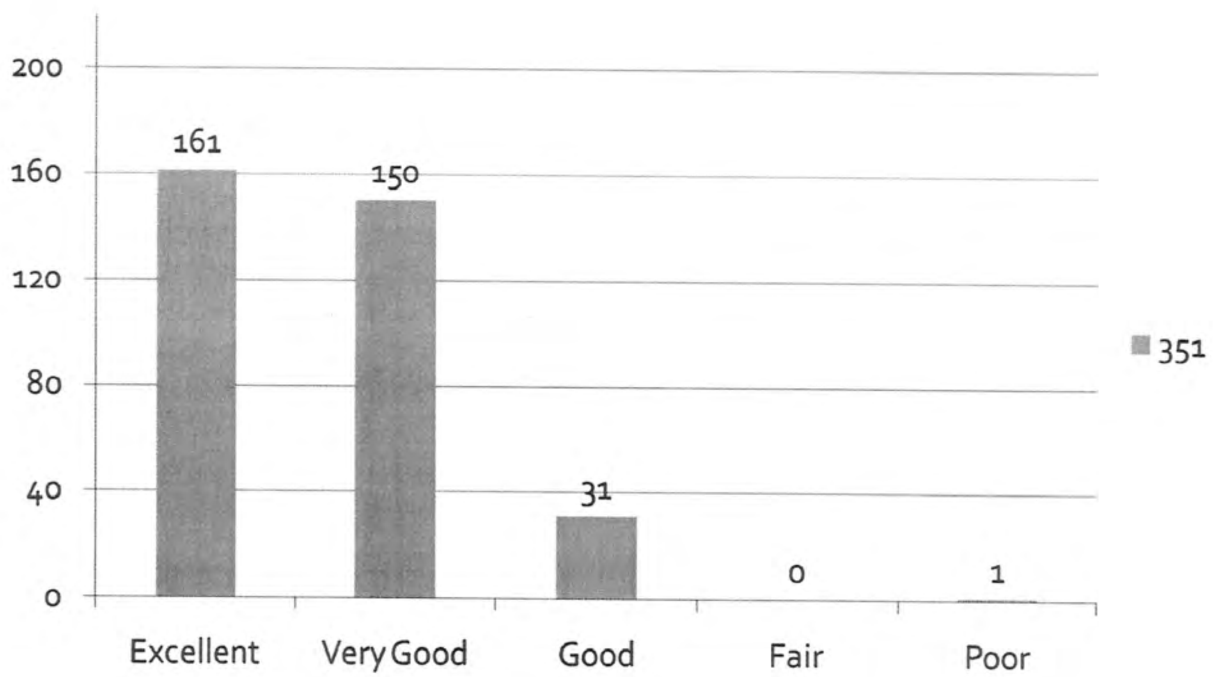


Figure 41

Rate objective 3: Evaluate the comparative efficacy, pharmacokinetics and contraindications of agents used in the treatment of insomnia.

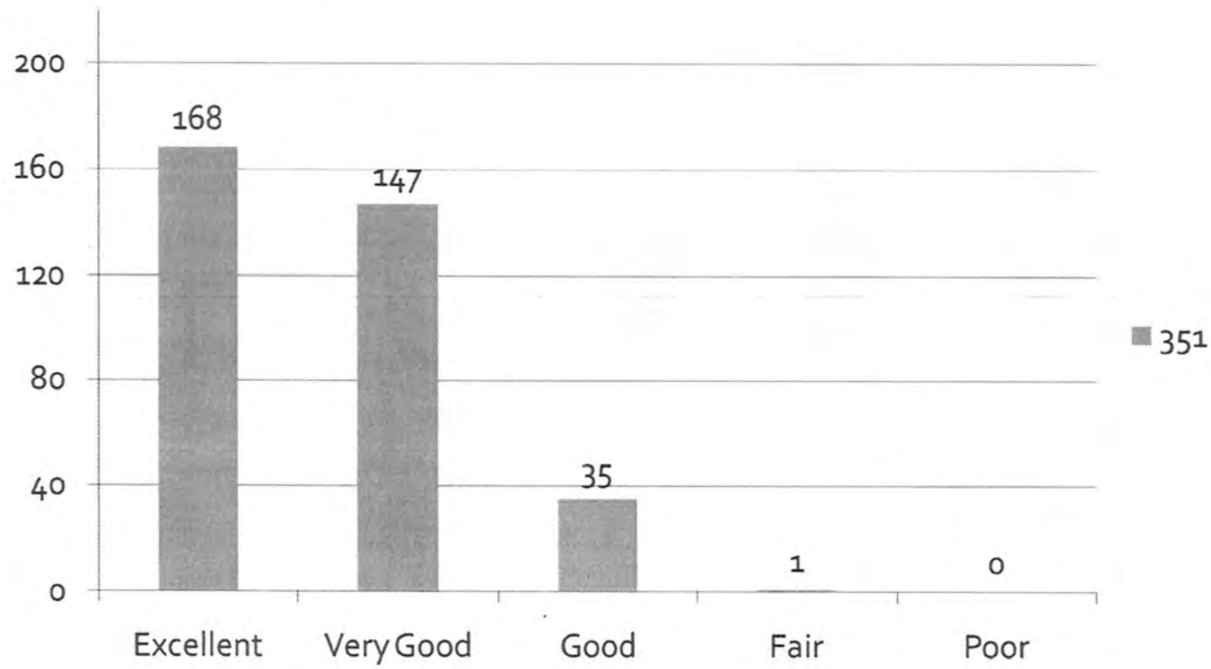


Figure 42

Rate objective 4: List strategies for pharmacists to educate and counsel patients with insomnia.

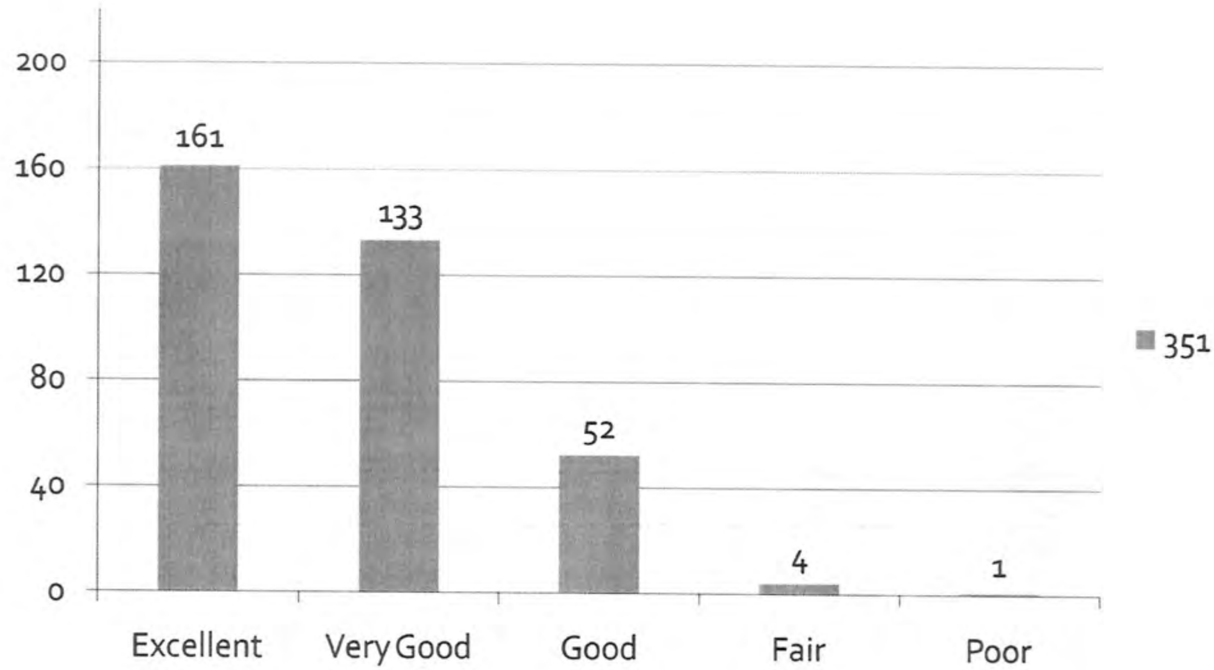


Figure 43

What is your overall evaluation of the CE activity?

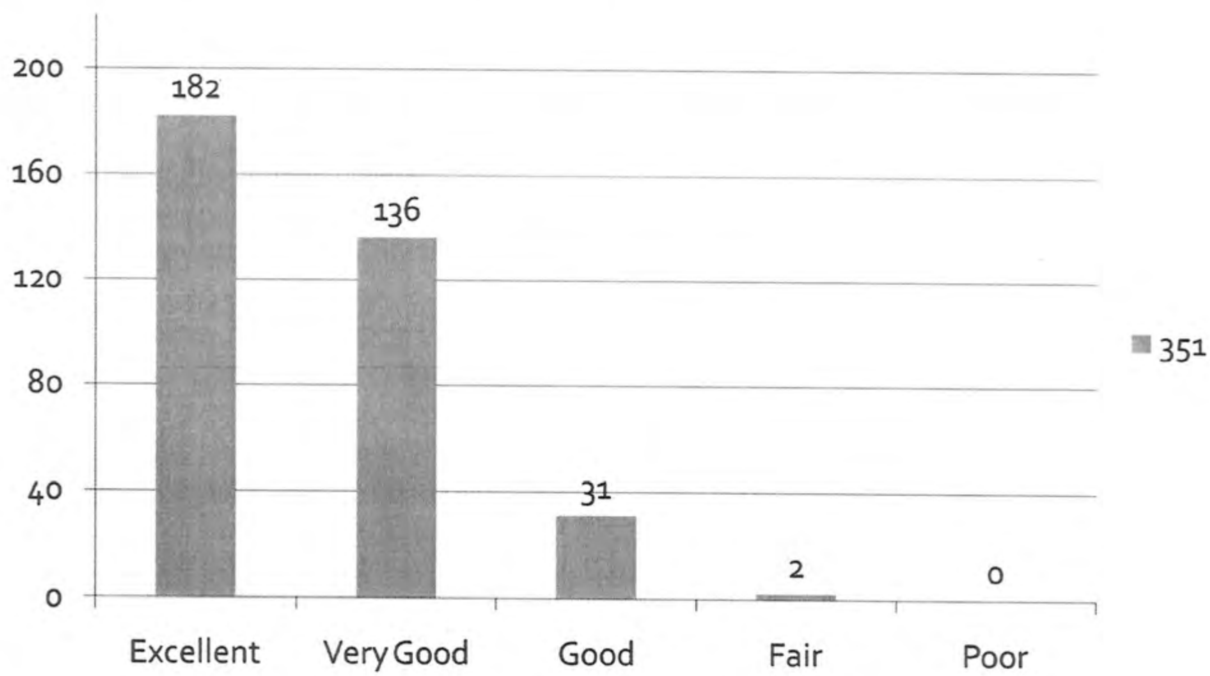


Figure 44

Rate the effectiveness of how well the instructor conveyed the subject matter

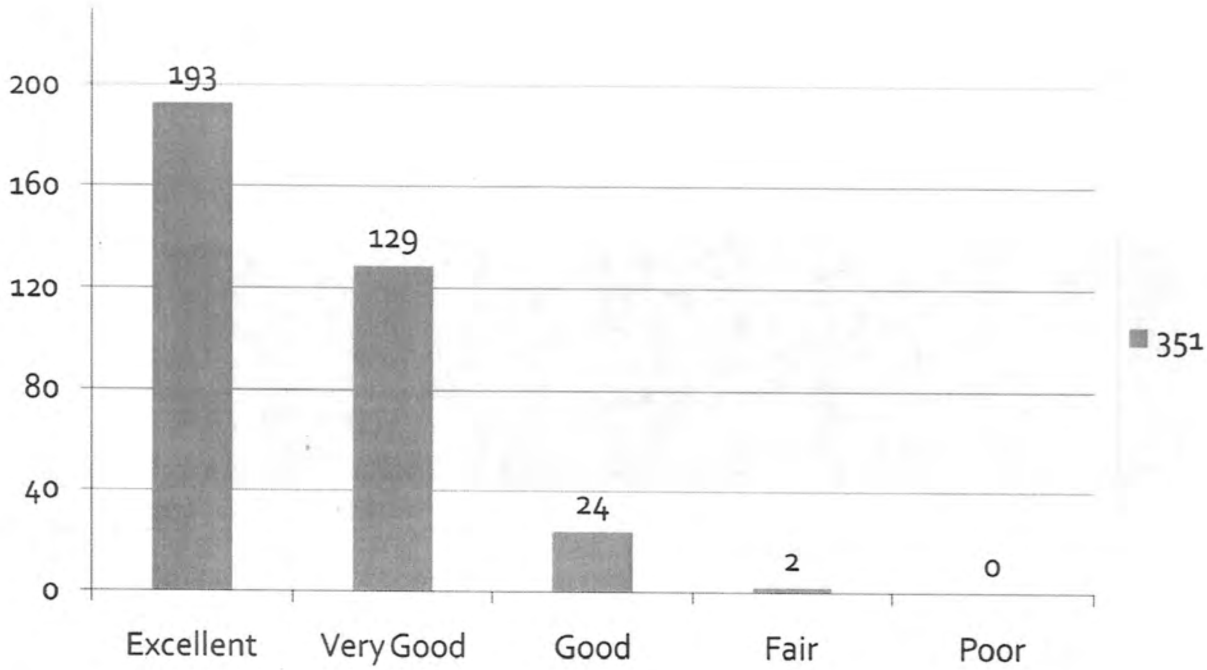


Figure 45

Rate the effectiveness of how well the activity related to your practice needs

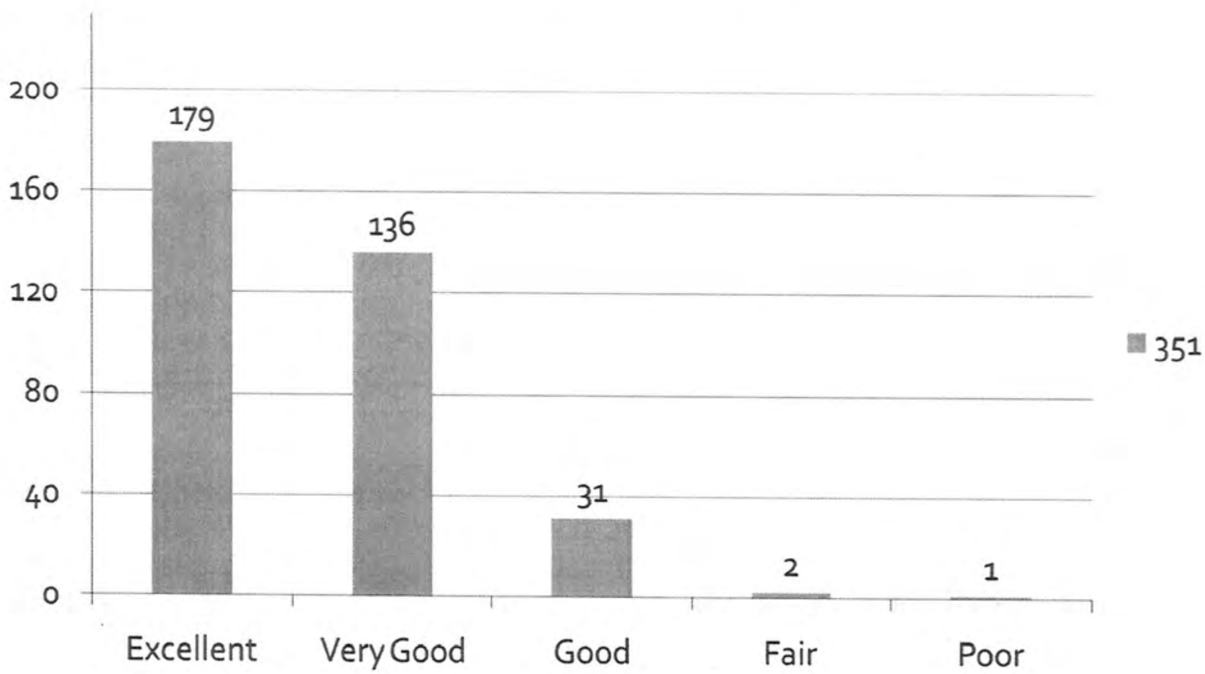
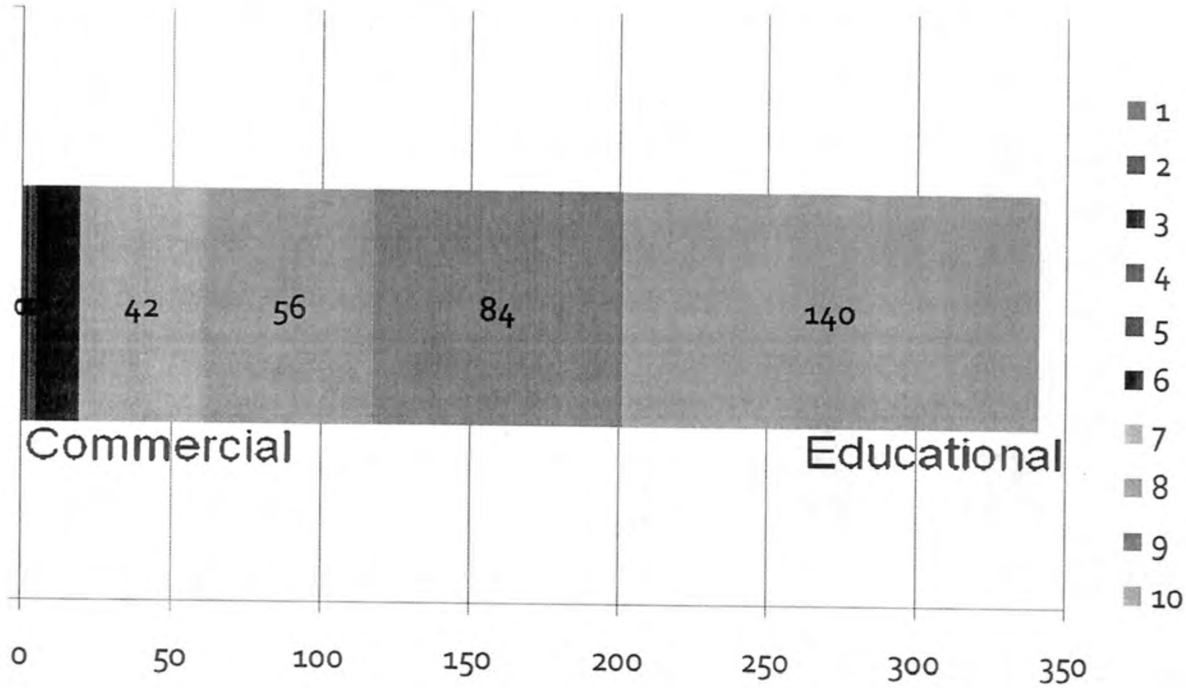


Figure 46

On a graded scale, did you perceive the presentation to be commercial or educational?



(7/11/07) Pharmacological Help for A Good Night's Sleep

Figure 47

Rate objective 1: Define insomnia and characterize the symptoms and array of causes.

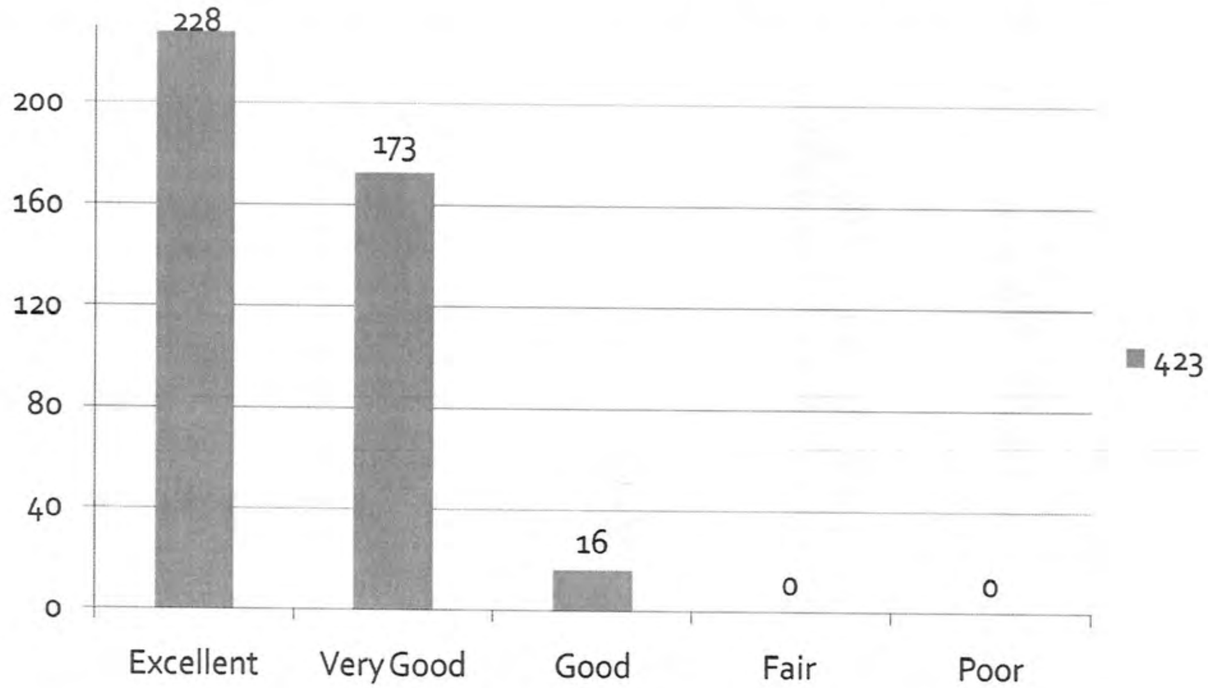


Figure 48

Rate objective 2: Describe traditional and new pharmacologic approaches to the management of insomnia.

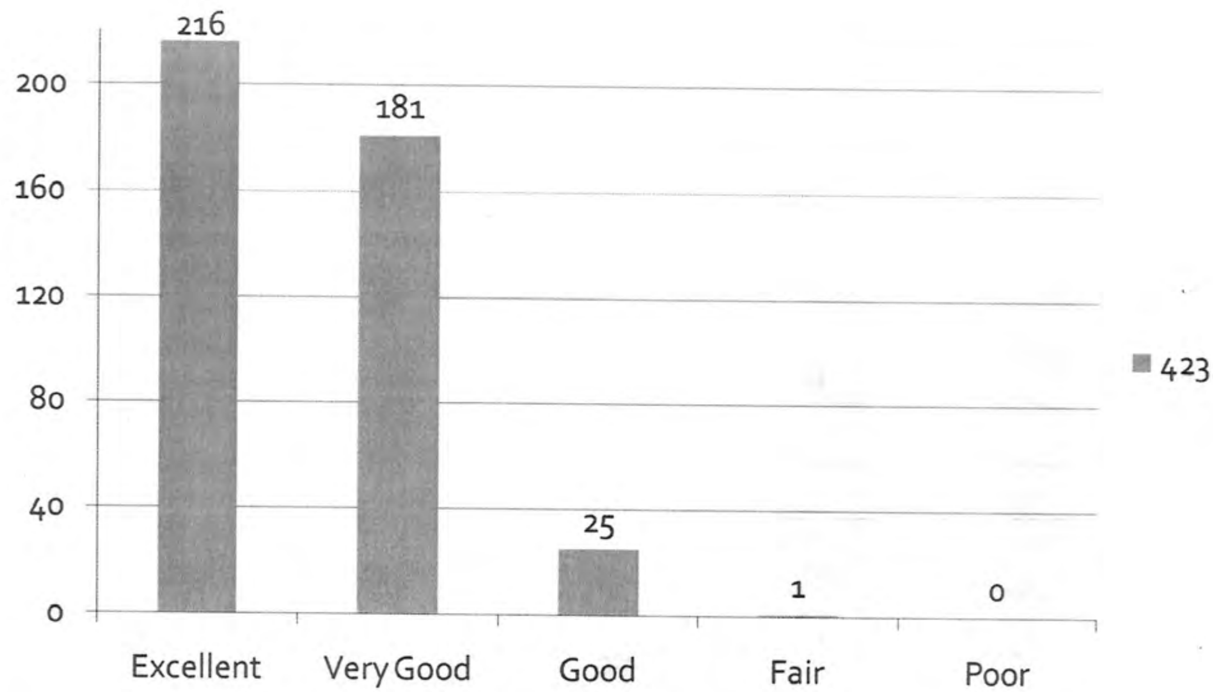


Figure 49

Rate objective 3: Evaluate the comparative efficacy, pharmacokinetics and contraindications of agents used in the treatment of insomnia.

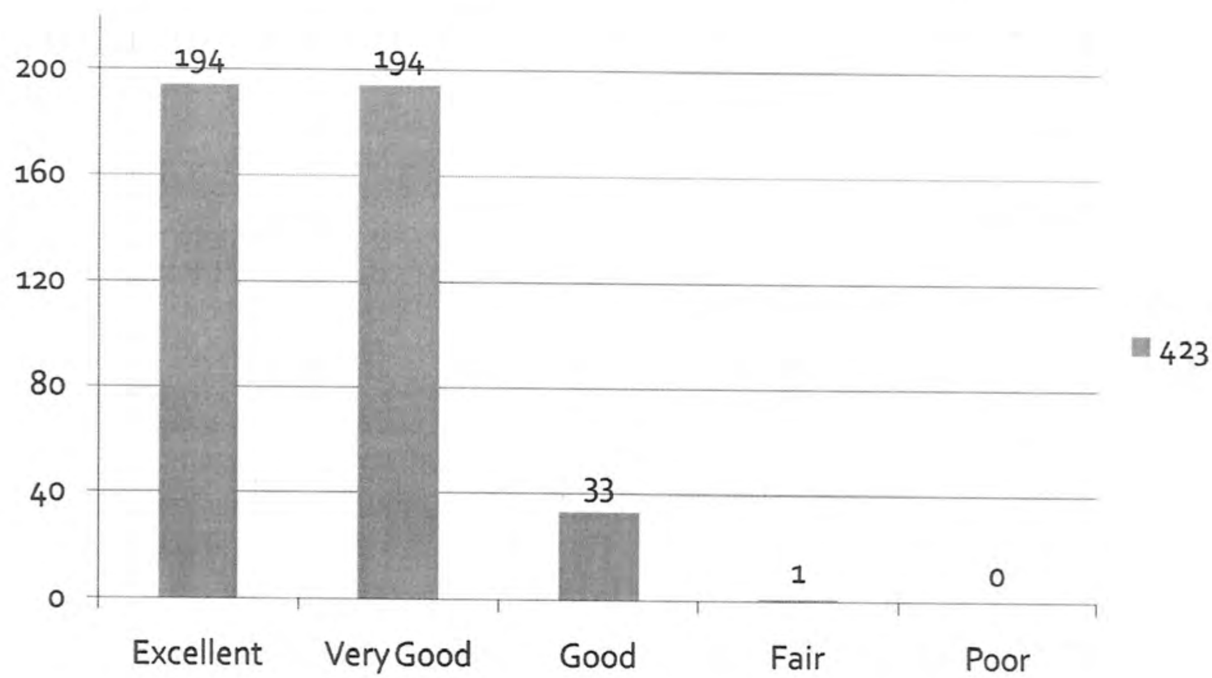


Figure 50

Rate objective 4: List strategies for pharmacists to educate and counsel patients with insomnia.

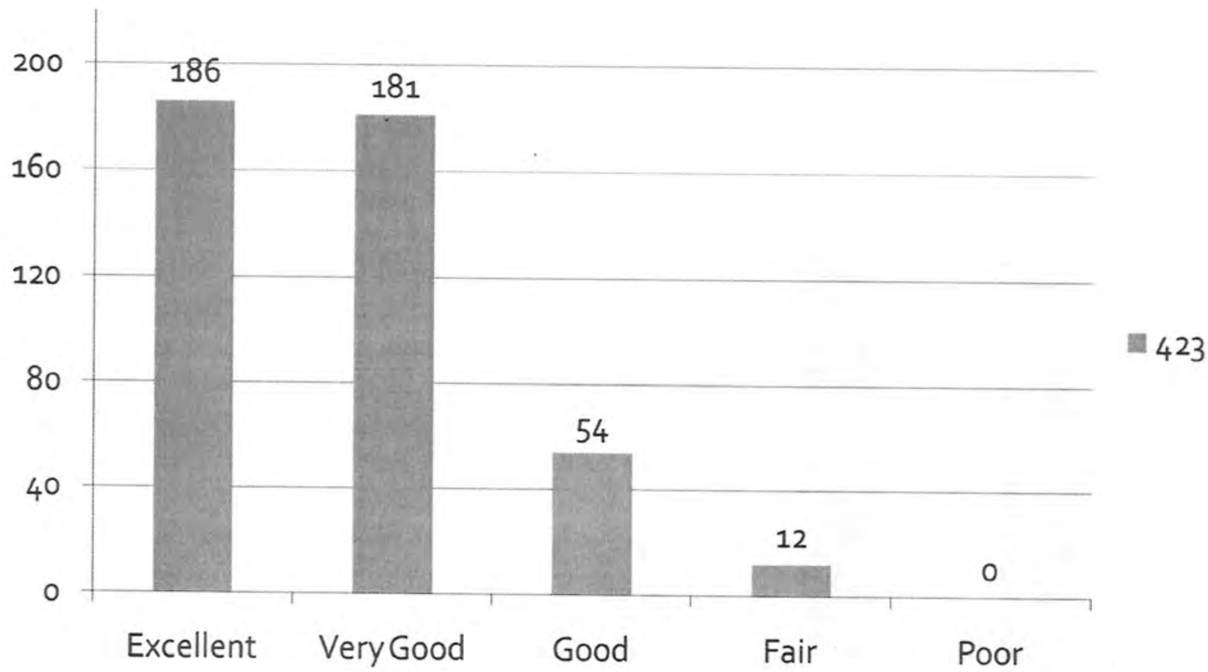


Figure 51

What is your overall evaluation of the CE activity?

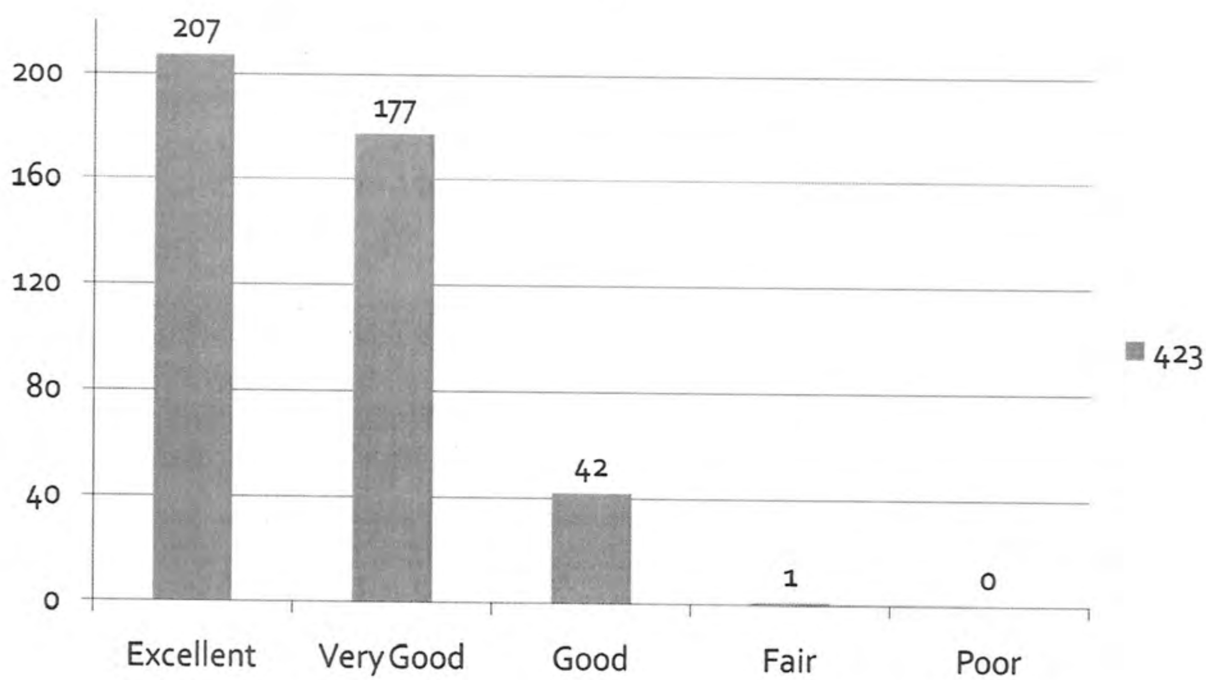


Figure 52

Overall, did this CE activity meet the objectives?

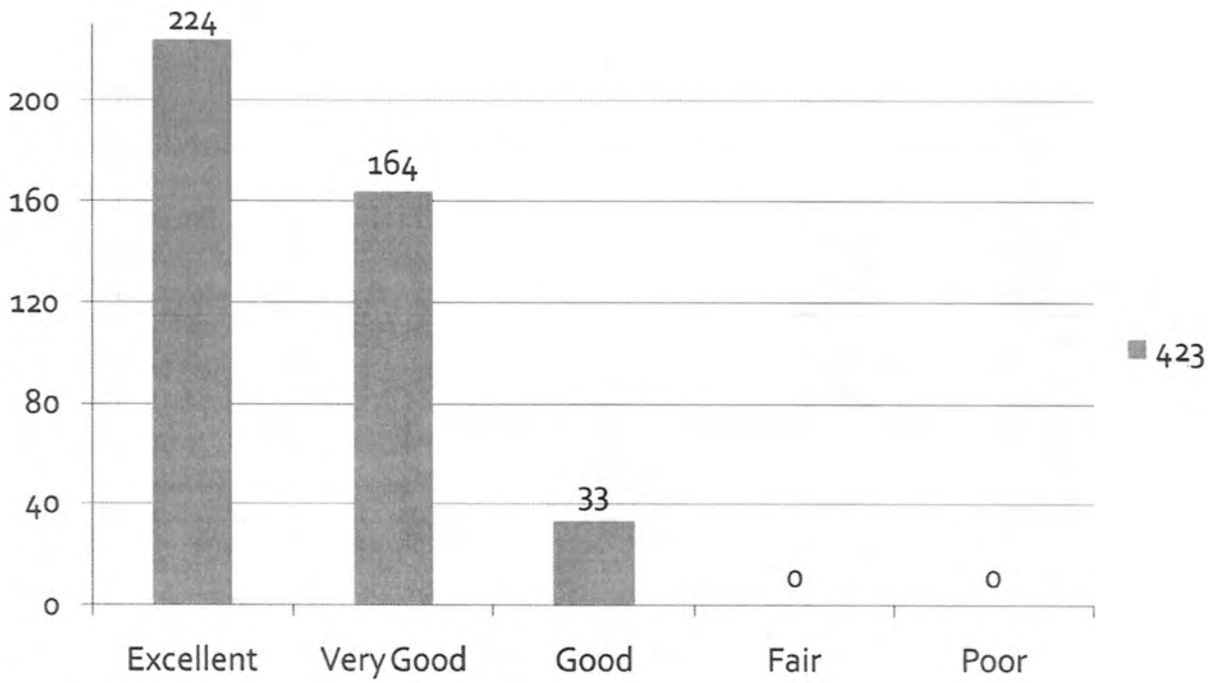


Figure 53

What is your overall evaluation of the CE activity content?

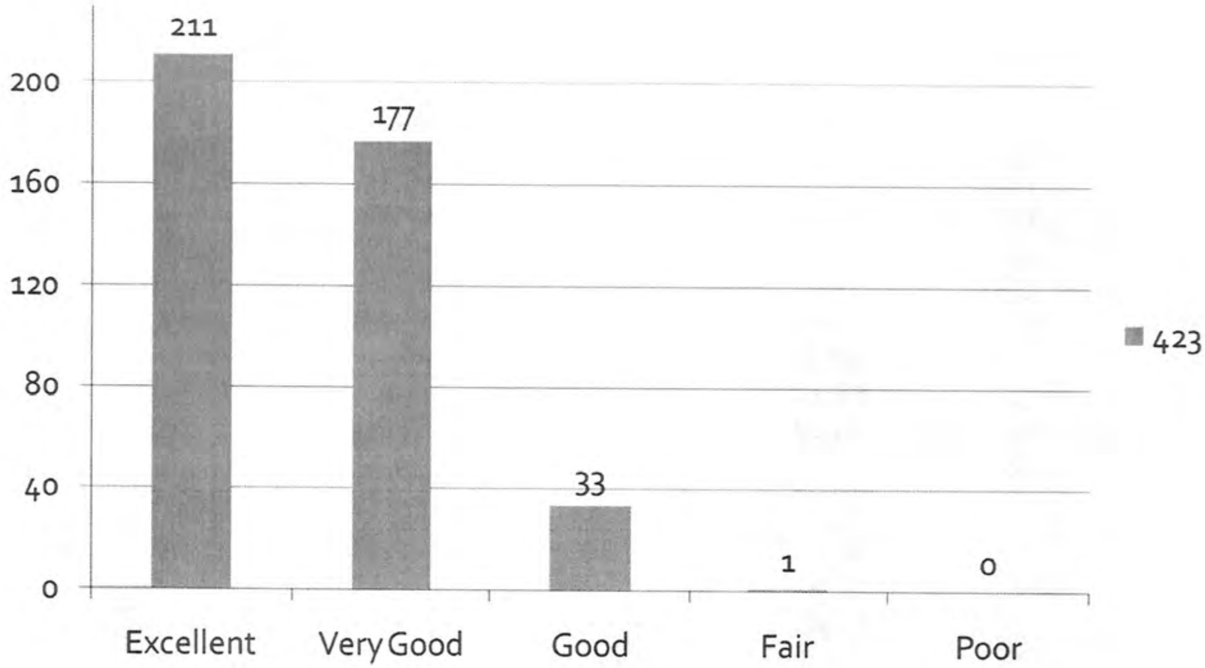


Figure 54

On a graded scale, did you perceive the presentation to be commercial or educational?

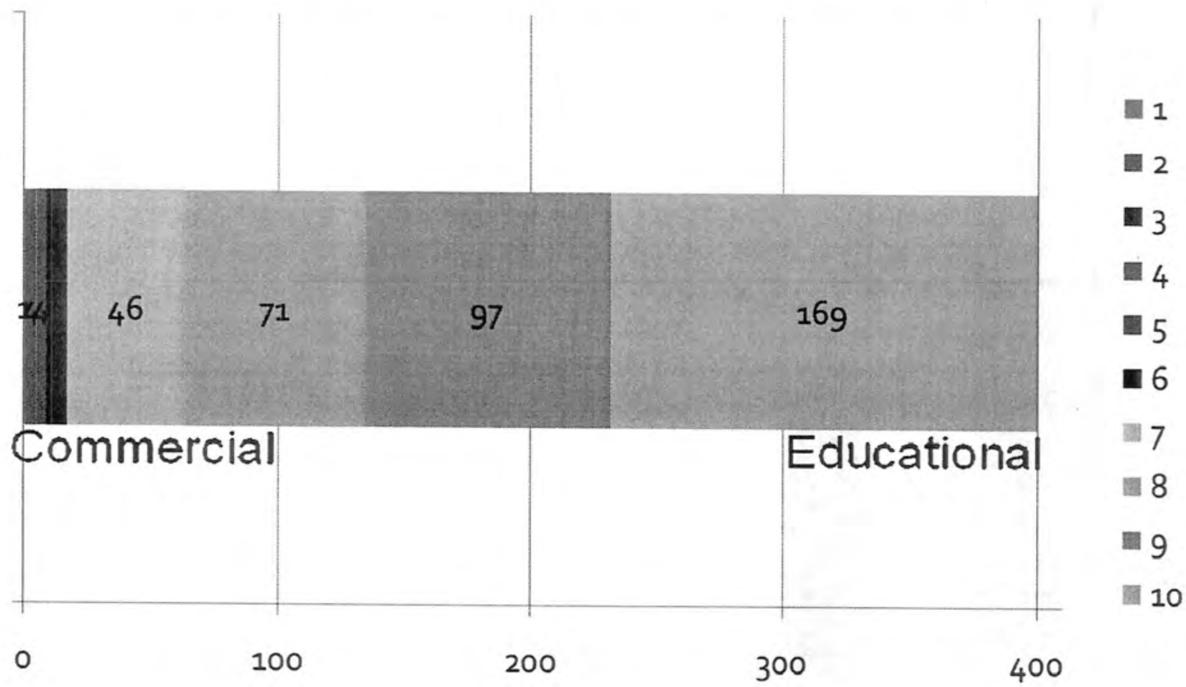


Figure 55

Overall preparation and organization of the speaker.

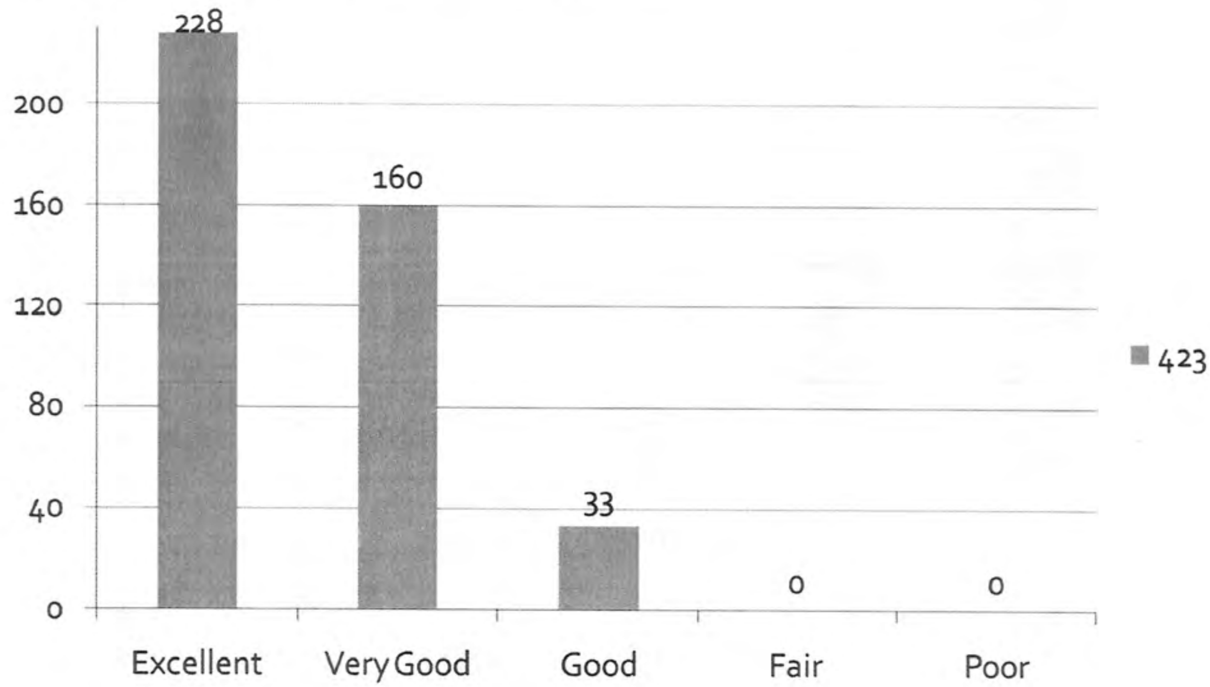


Figure 56

Overall knowledge of the speaker for this topic area.

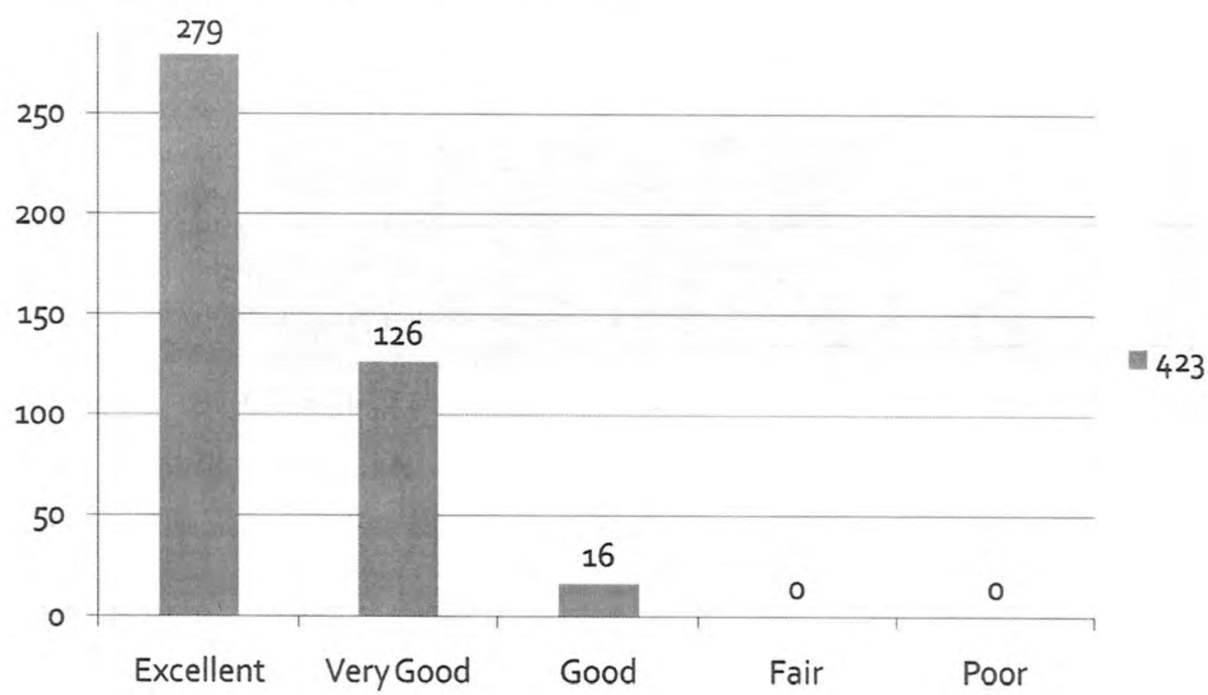


Figure 57

Presentation style, teaching strategies of the speaker.

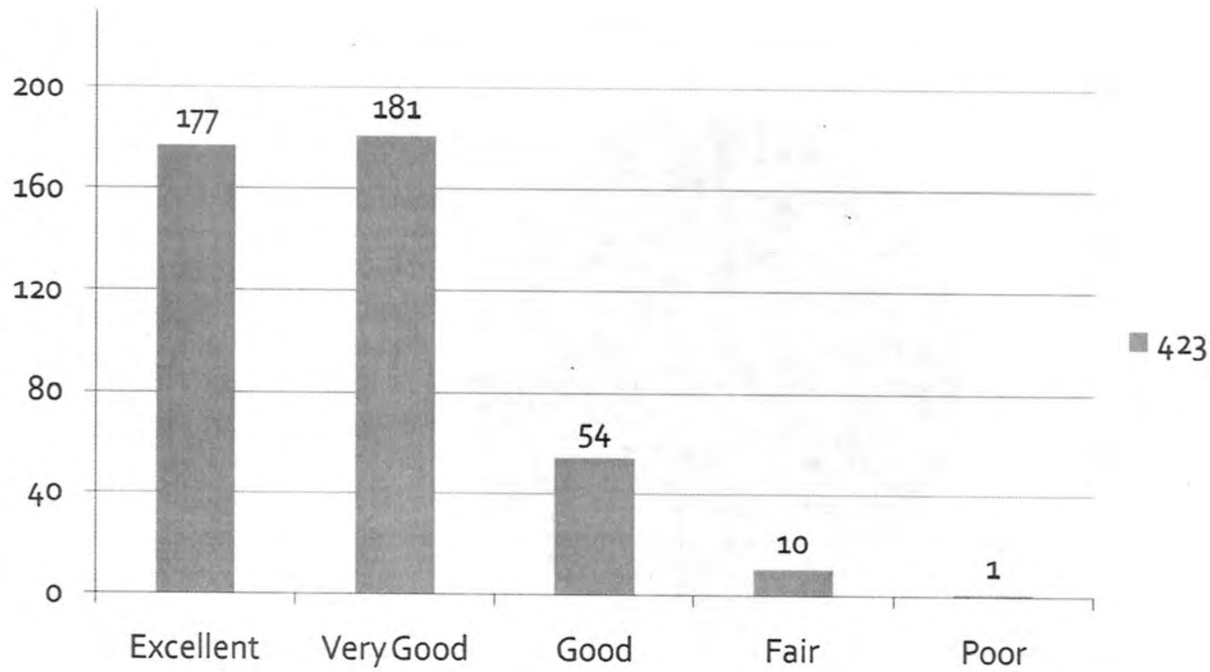


Figure 58

Did the speaker encourage and answer questions satisfactorily?

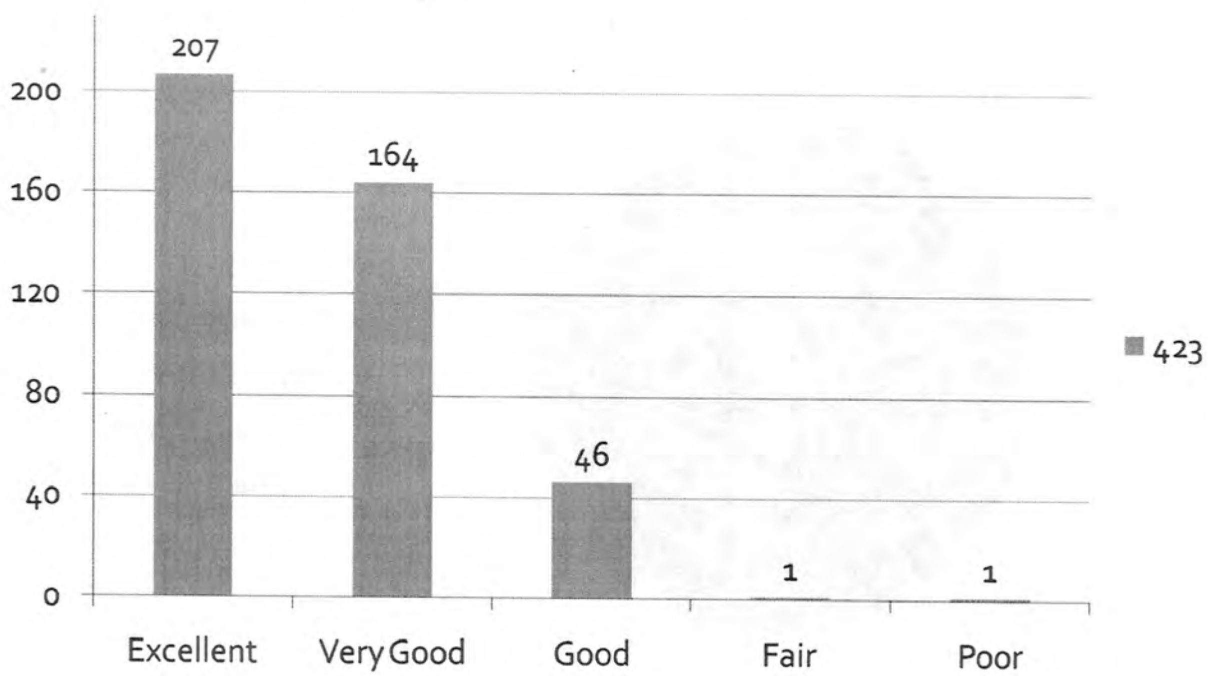


Figure 59

Have you participated in a web cast before?

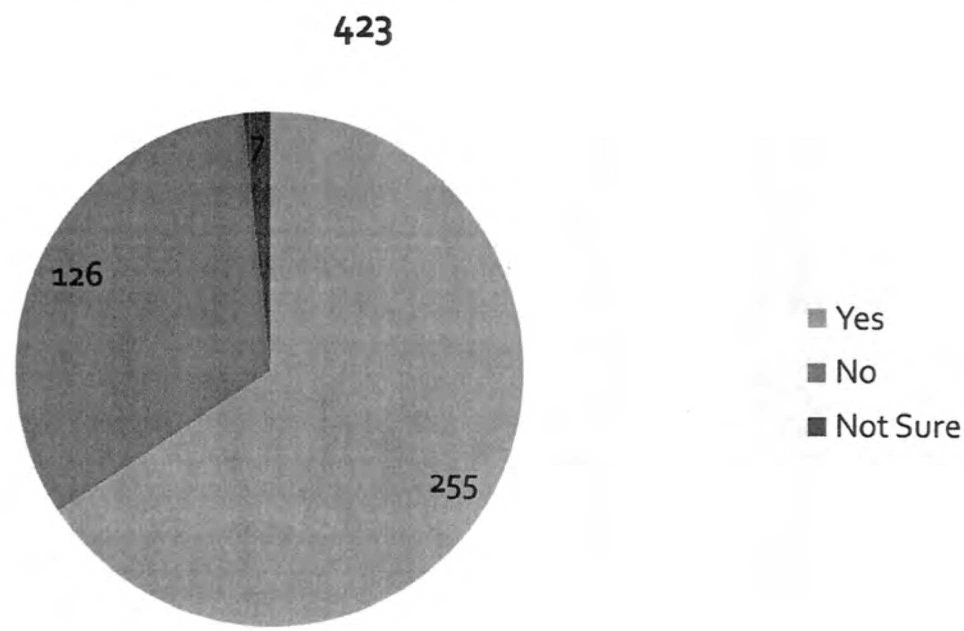


Figure 60

How did you find out about this webcast?

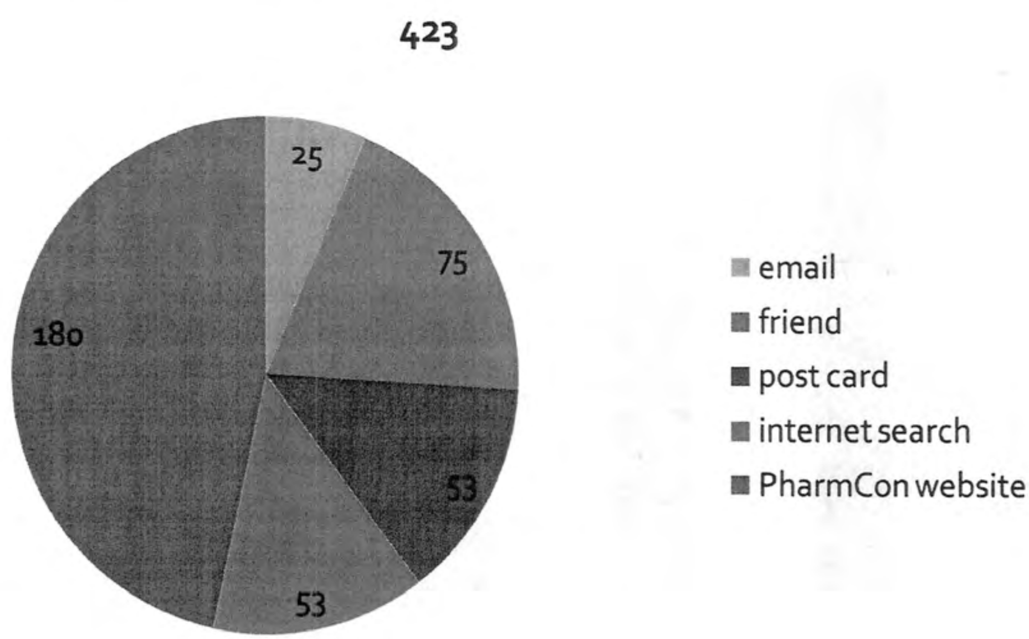
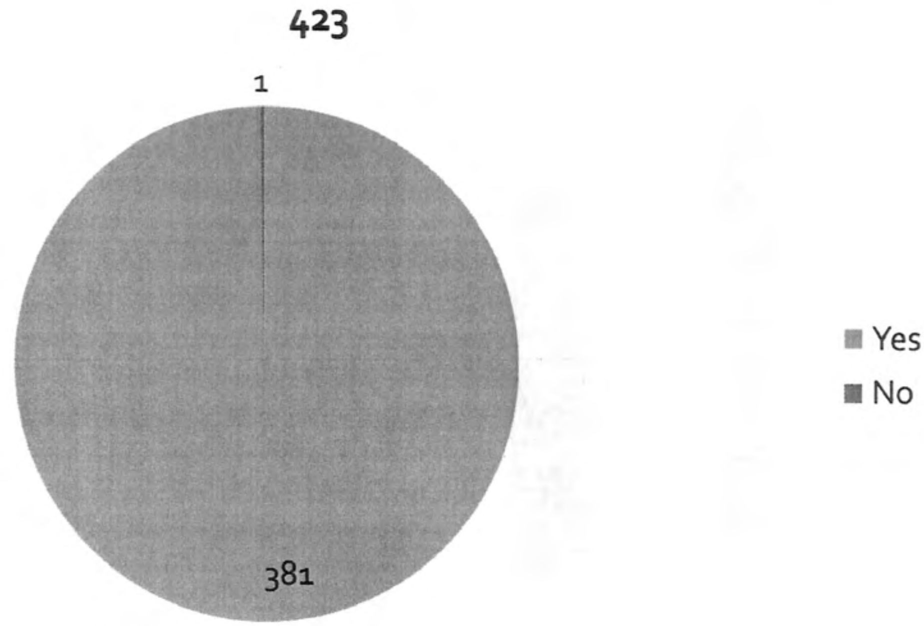


Figure 61

Would you recommend a webcast to a friend/colleague?



Treatment of Anemia (online monograph)

Figure 62

Rate objective 1: Describe the classifications of anemia.

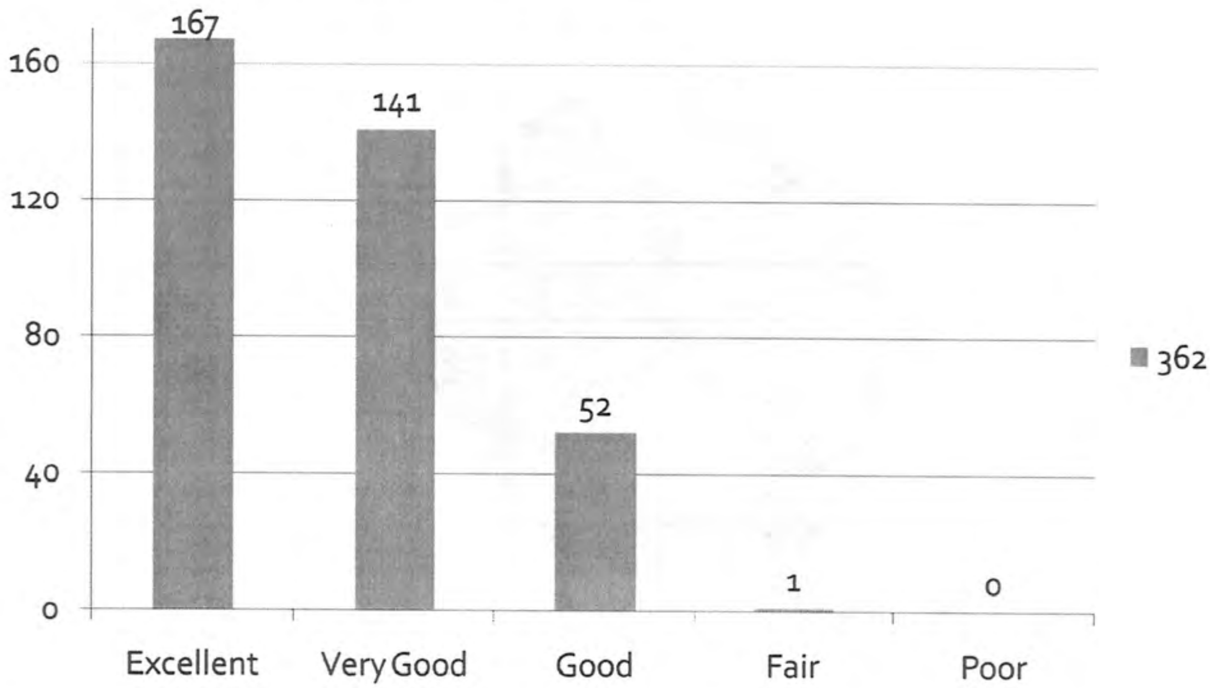


Figure 63

Rate objective 2: Identify underlying causes and conditions associated with anemic disorders.

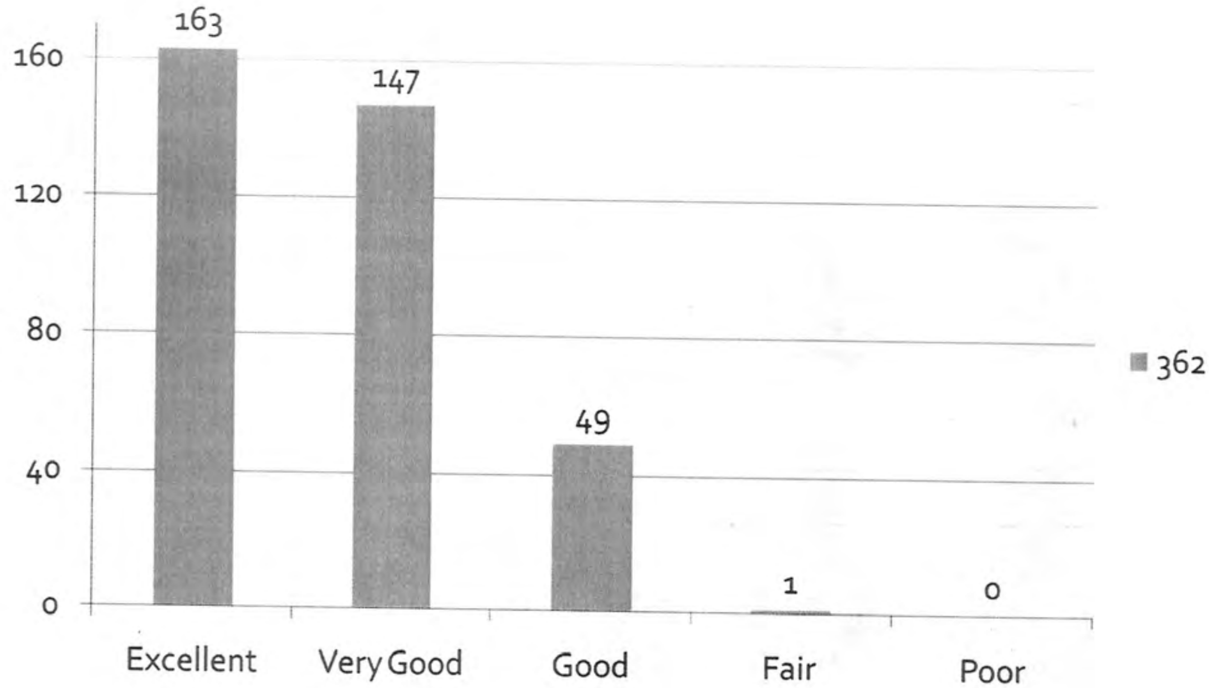


Figure 64

Rate objective 3: Describe the more common anemia.

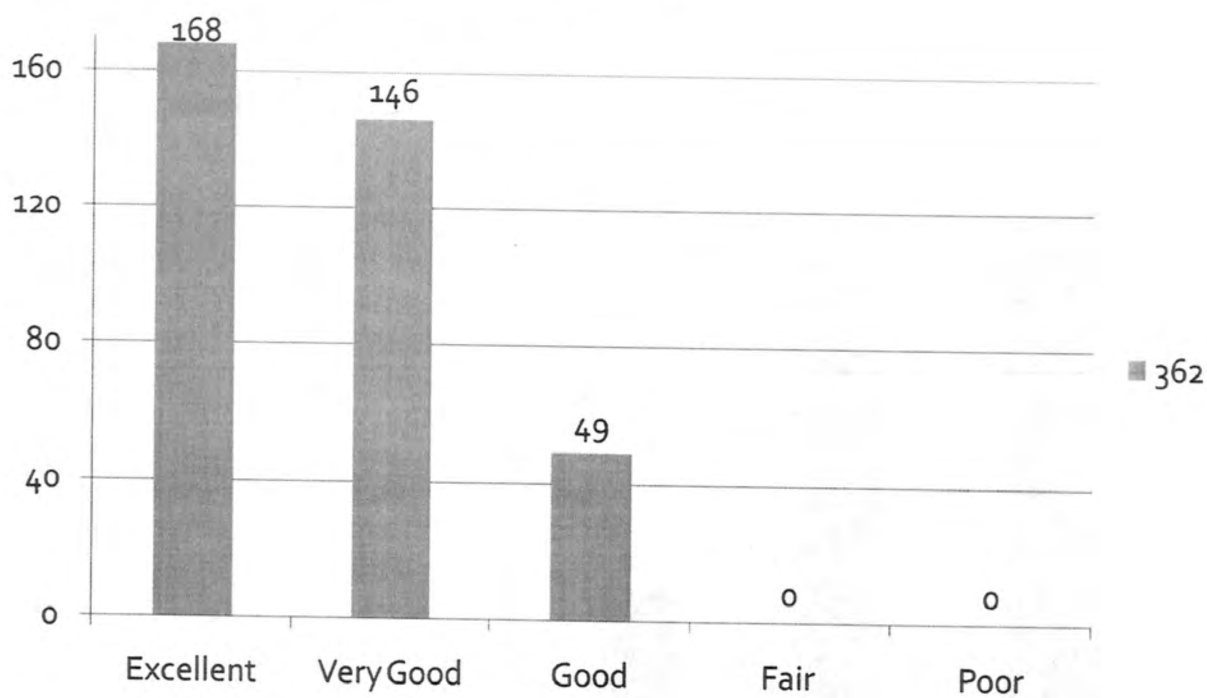


Figure 65

Rate objective 4: Describe the clinical presentation of anemia.

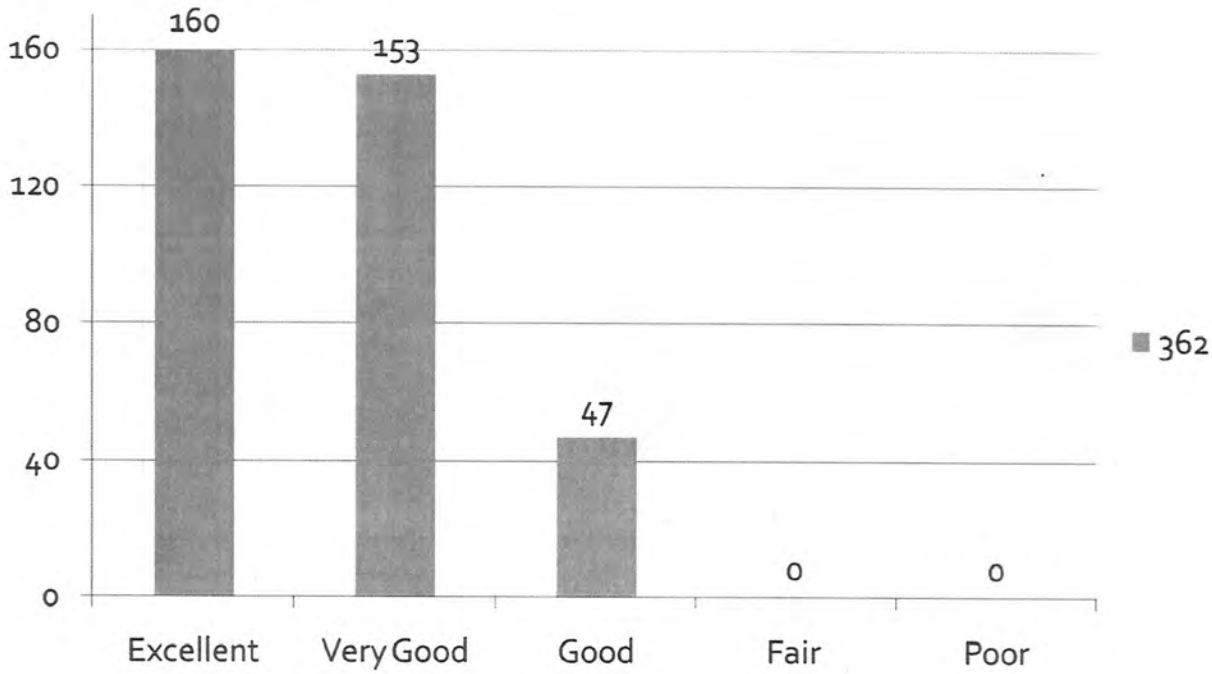


Figure 66

Rate objective 5: Identify normal lab values versus lab values found in active disease.

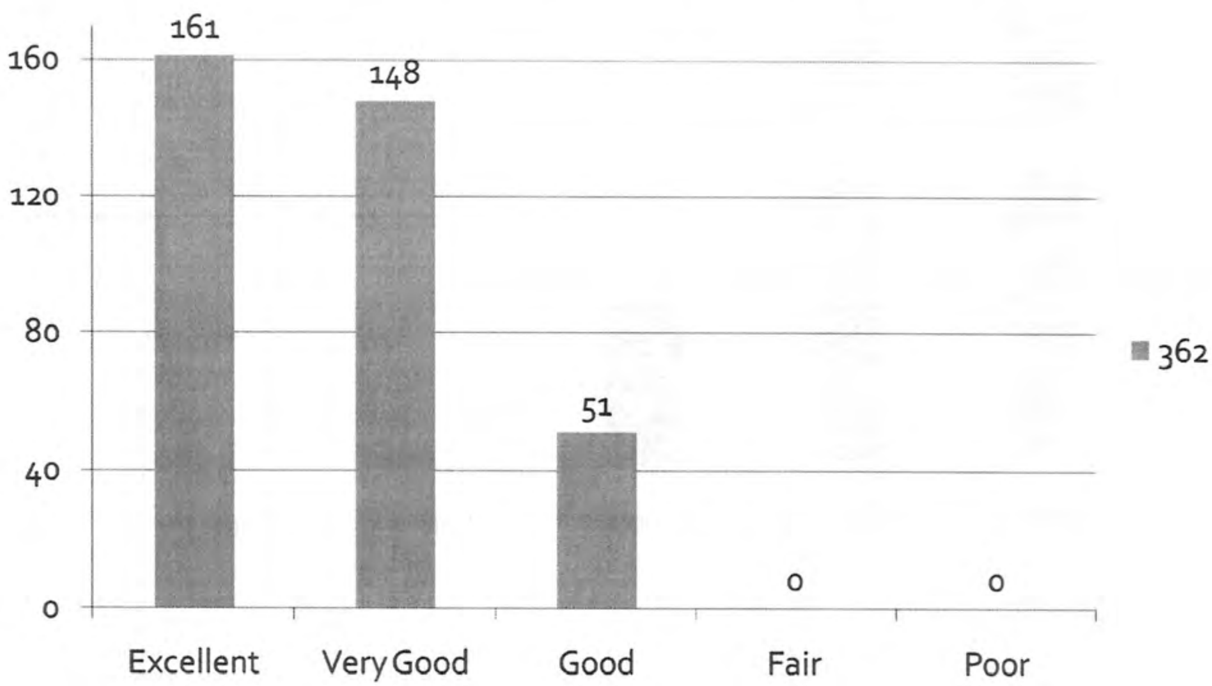


Figure 67

Rate objective 6: Differentiate between appropriate treatment options.

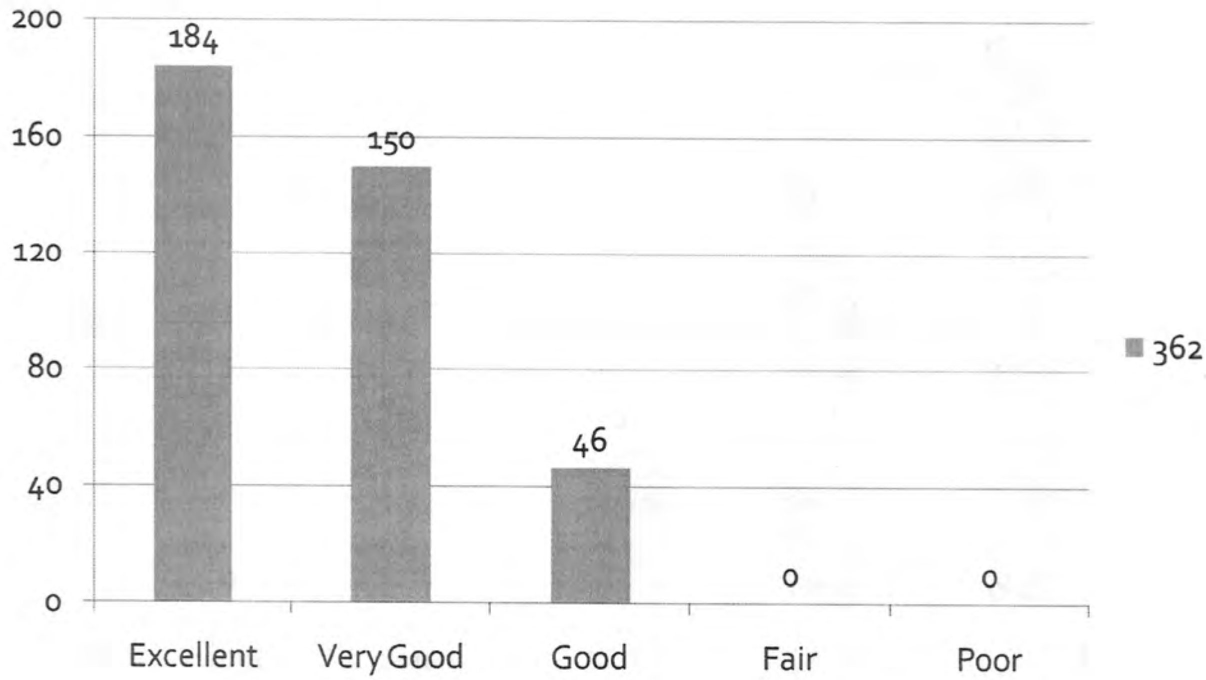


Figure 68

What is your overall evaluation of the monograph (article) and the exam?

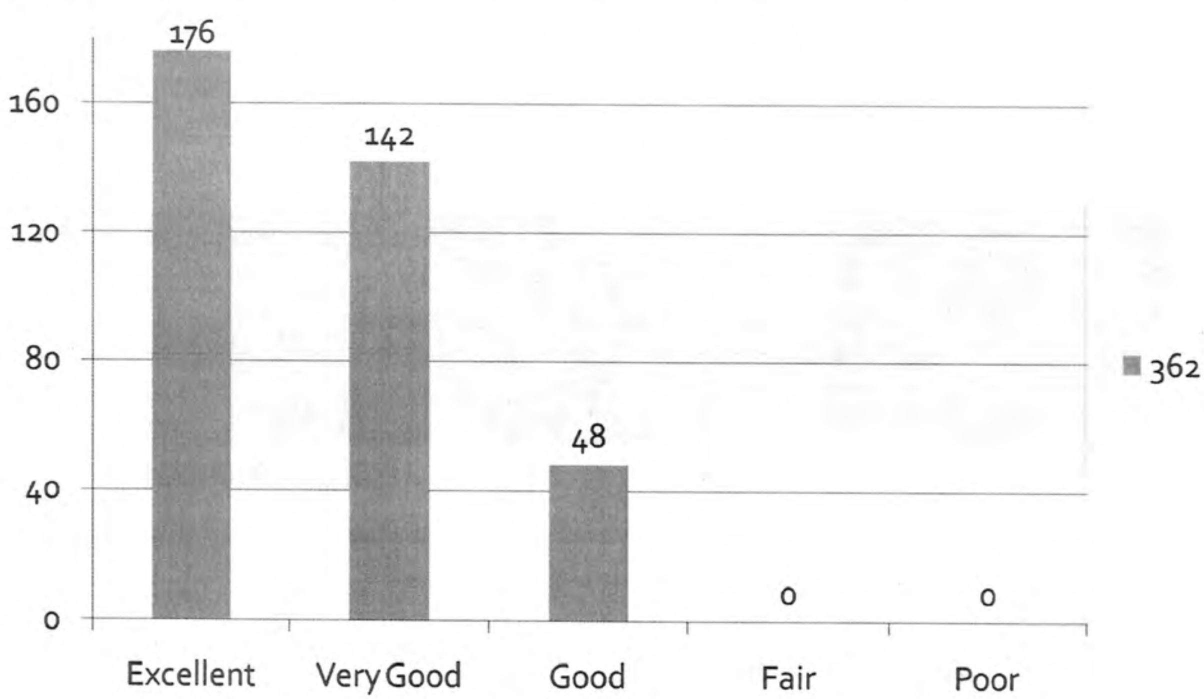


Figure 69

How well did this monograph (article) and exam meet the objectives?

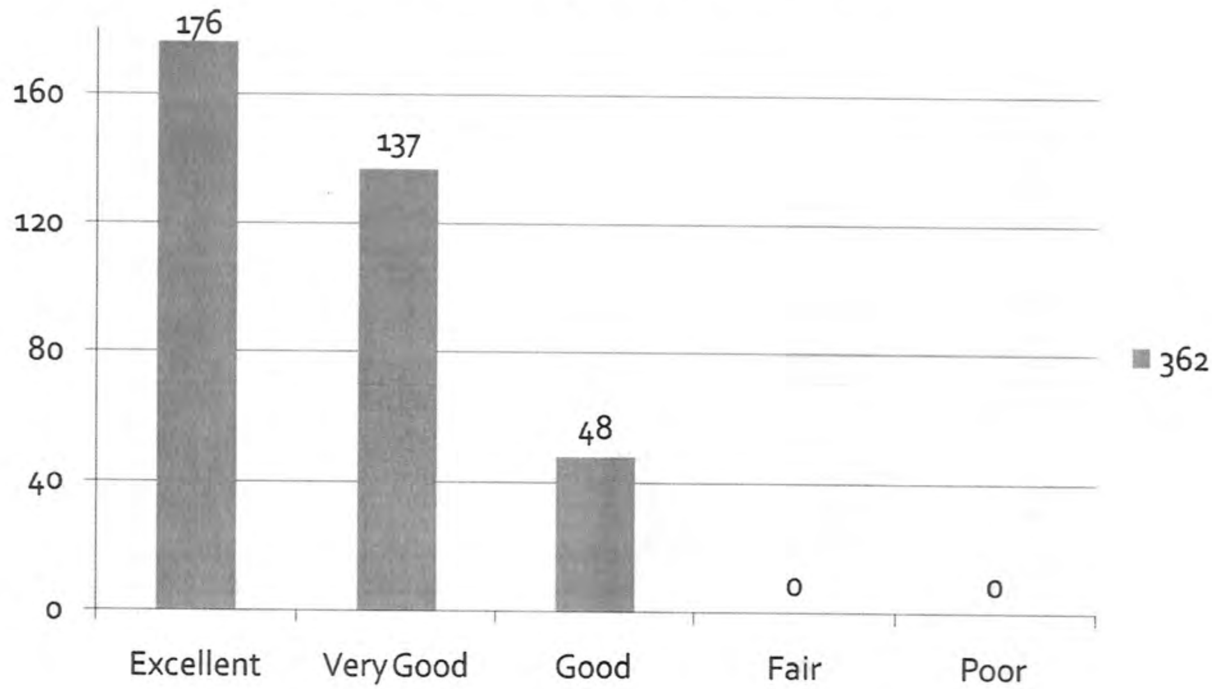


Figure 70

On a graded scale, did you perceive the presentation to be commercial or educational?

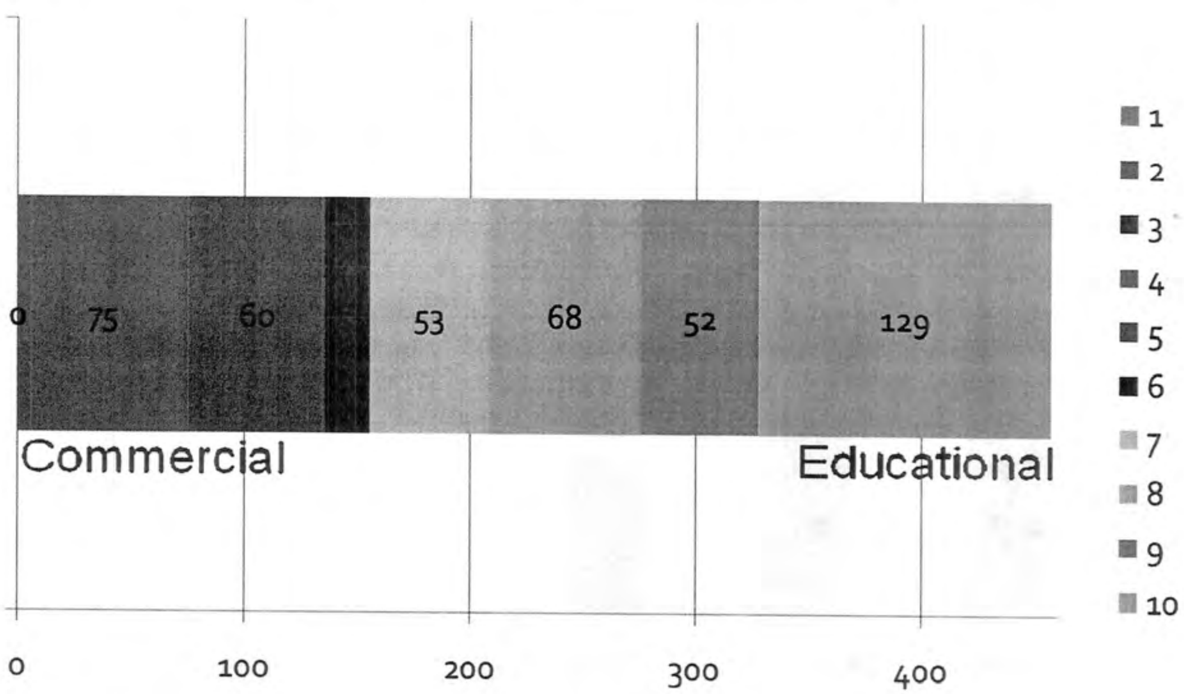
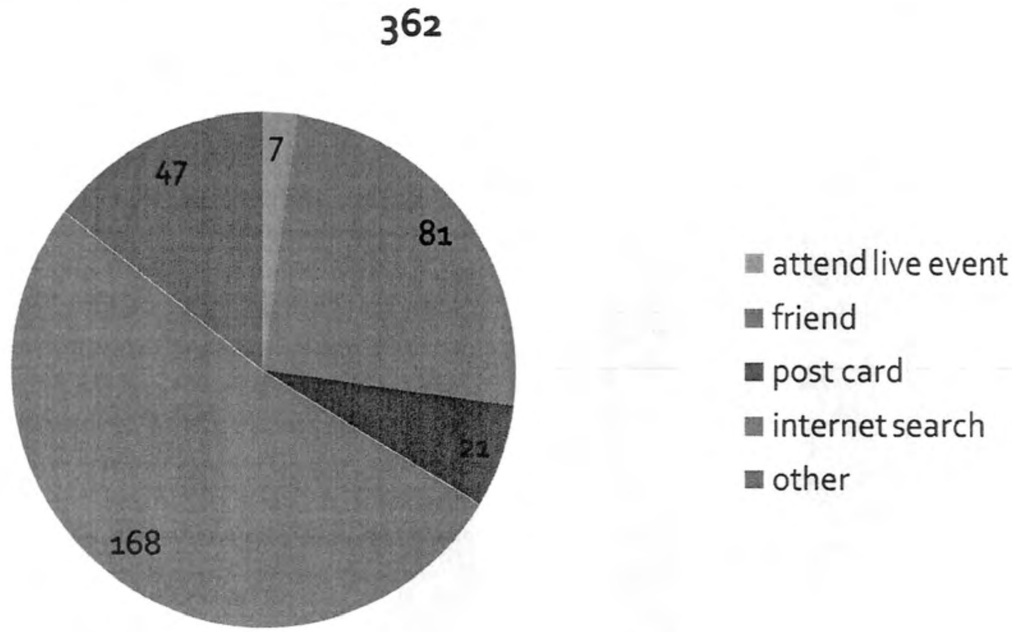


Figure 71

How did you find out about this monograph?



Treatment of Congestive Heart Failure (online monograph)

Figure 72

Rate objective 1: Discuss the pathophysiology of the heart that contributes to the development and progression of CHF

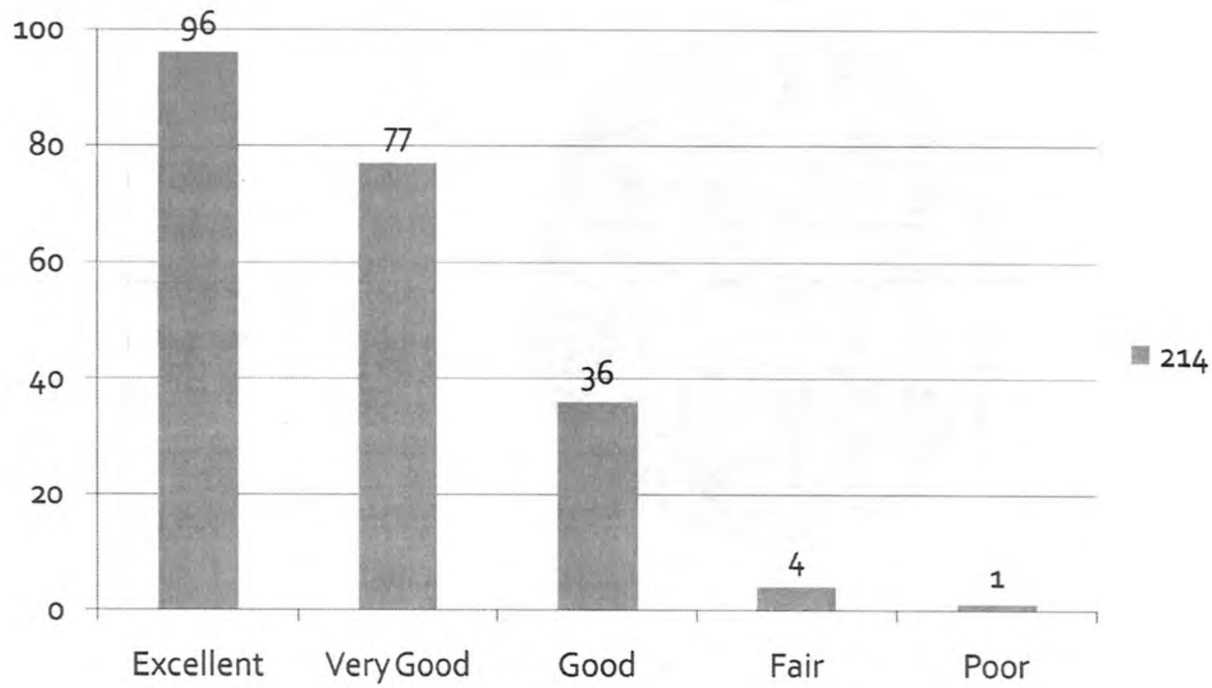


Figure 73

Rate objective 2: Identify underlying disorders associated with the development of CHF.

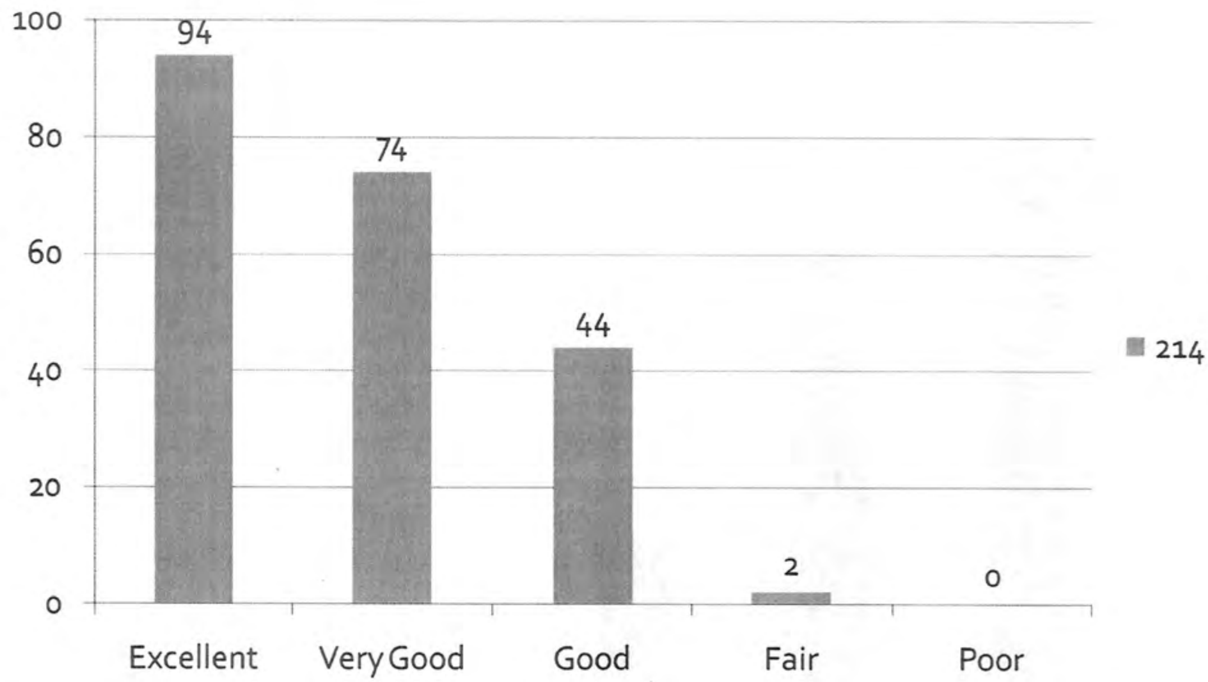


Figure 74

Rate objective 3: Discuss non-pharmacological measures as well as first line pharmacological treatment options.

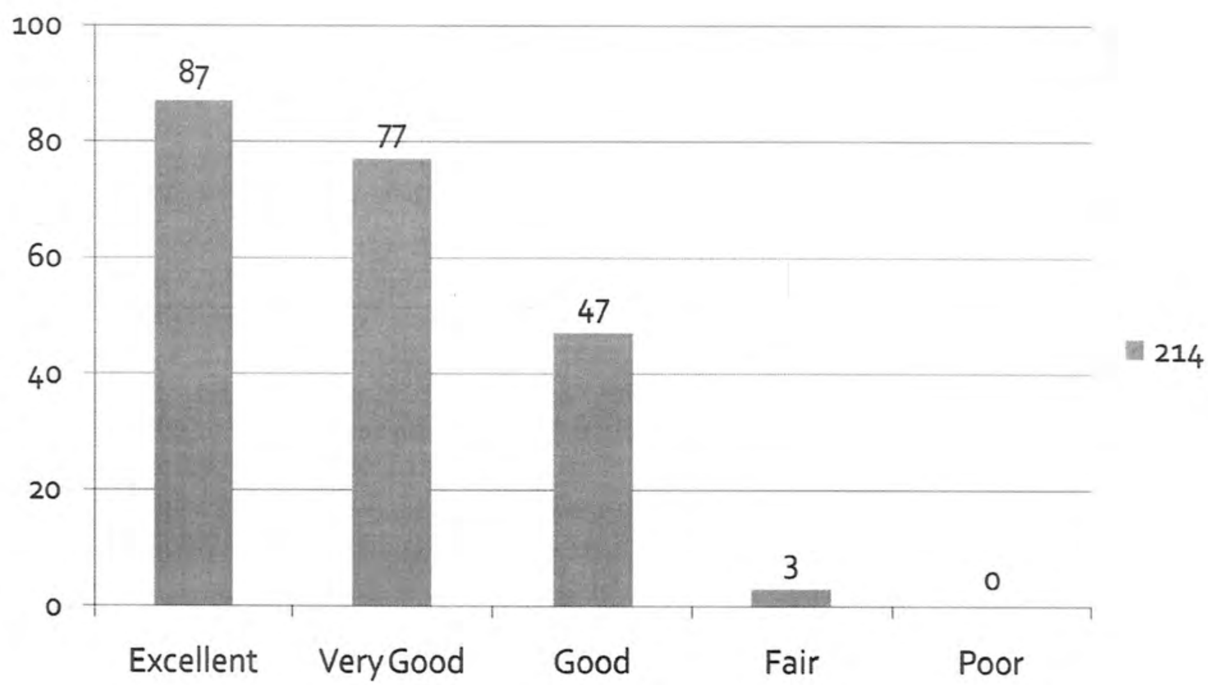


Figure 75

Rate objective 4: Identify pharmaceutical classes used in the treatment of CHF.

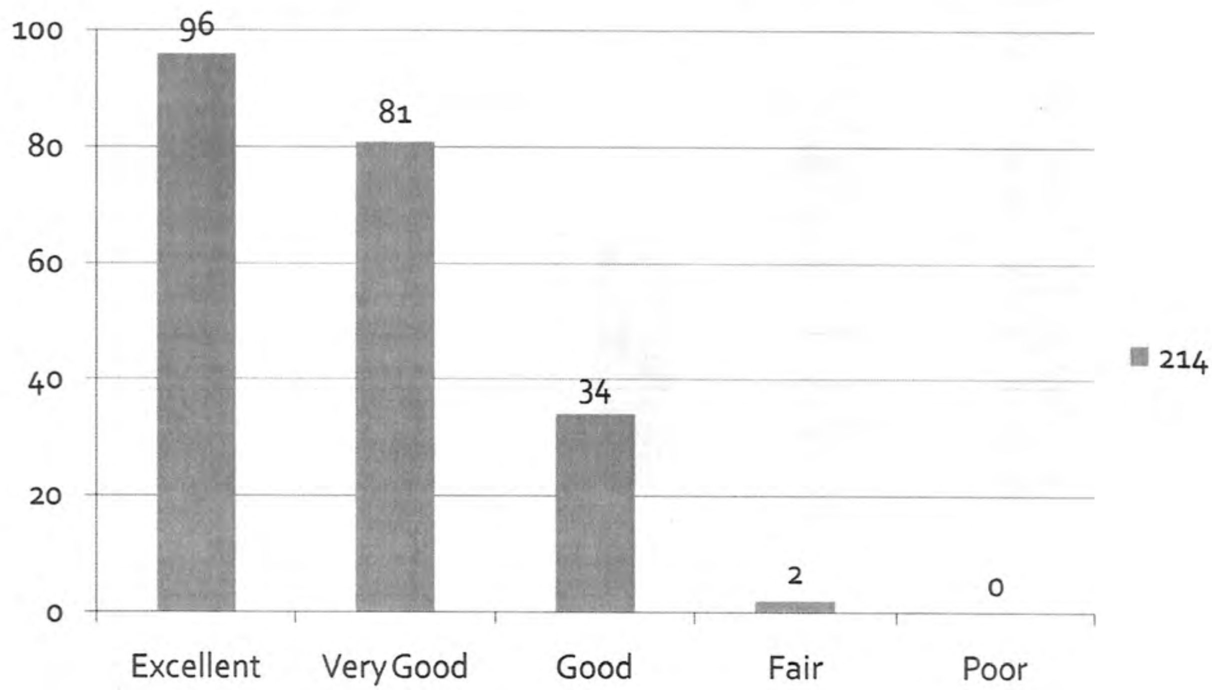


Figure 76

Rate objective 5: Discuss affects of pharmacological treatments on morbidity and mortality of the heart failure patient.

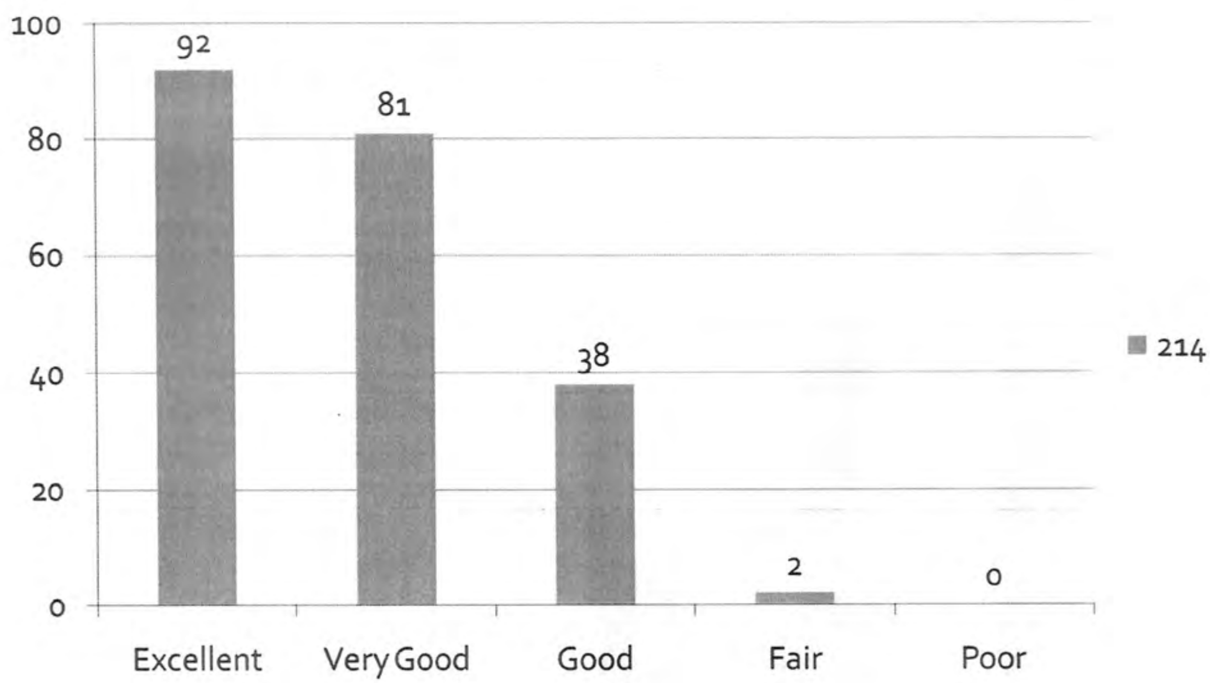


Figure 77

Rate objective 6: Differentiate between pharmaceuticals used in long term management versus those used to treat the acutely de-compensated heart failure patient.

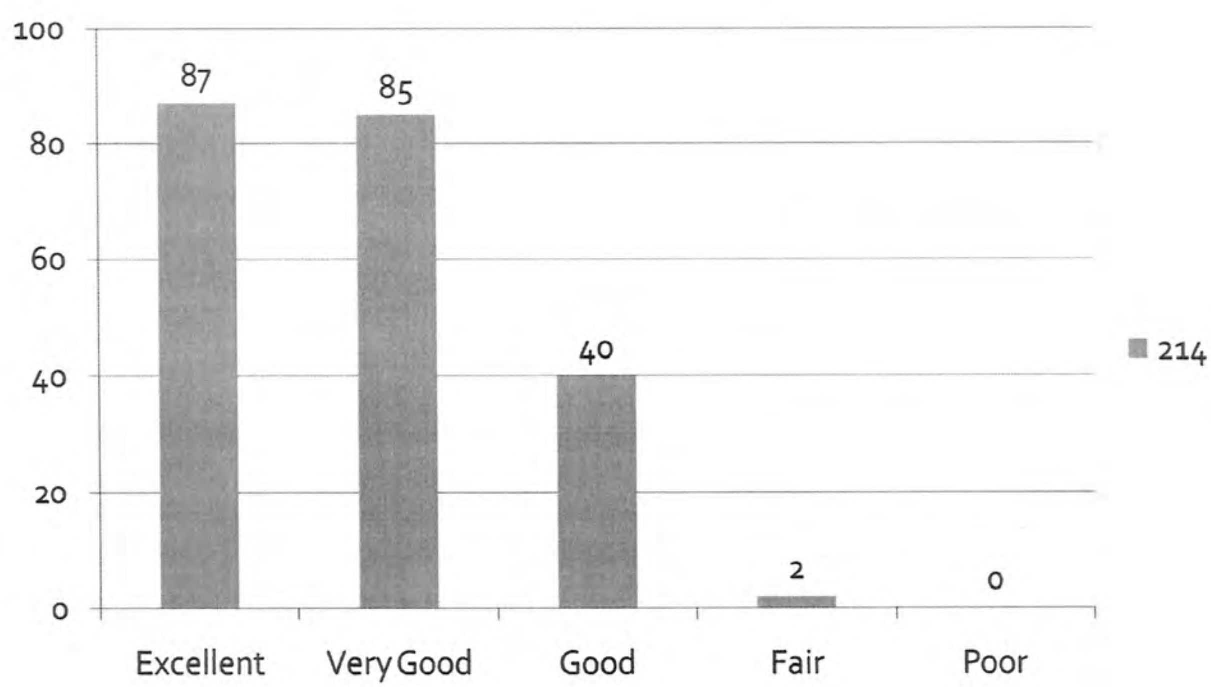


Figure 78

Rate objective 7: Identify the most recent peptide marker used in the diagnosis of the CHF patient.

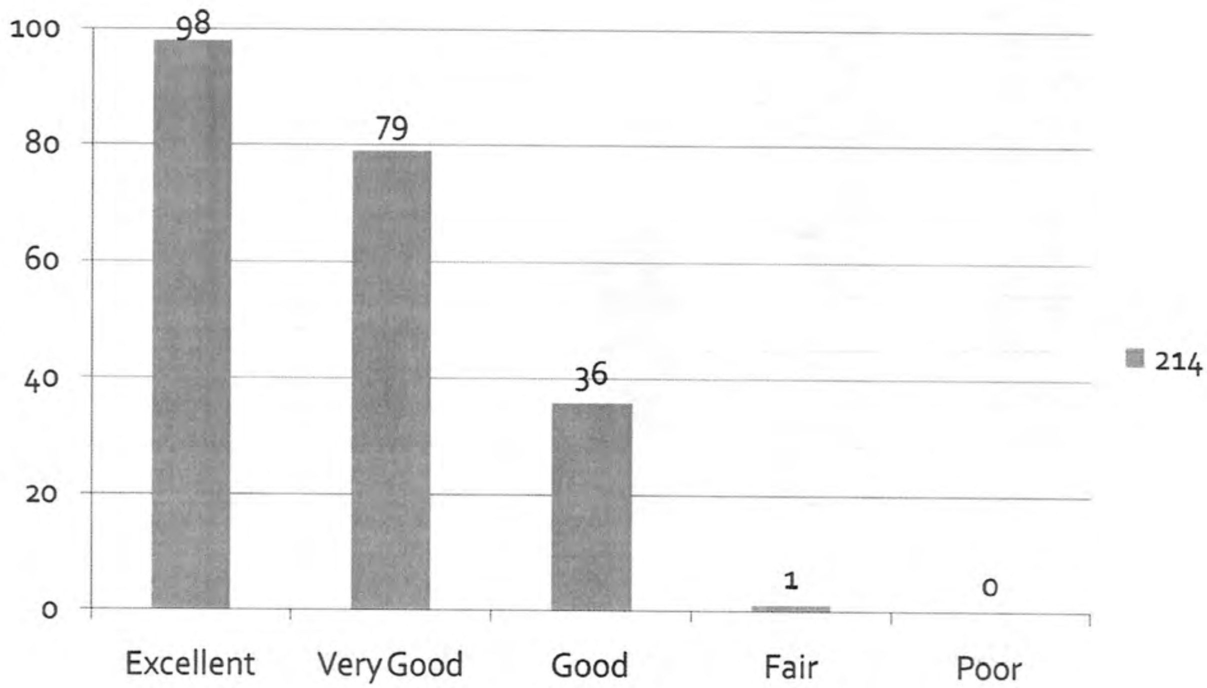


Figure 79

Rate objective 8: Discuss the pharmacology of IV medications used in the acute care setting.

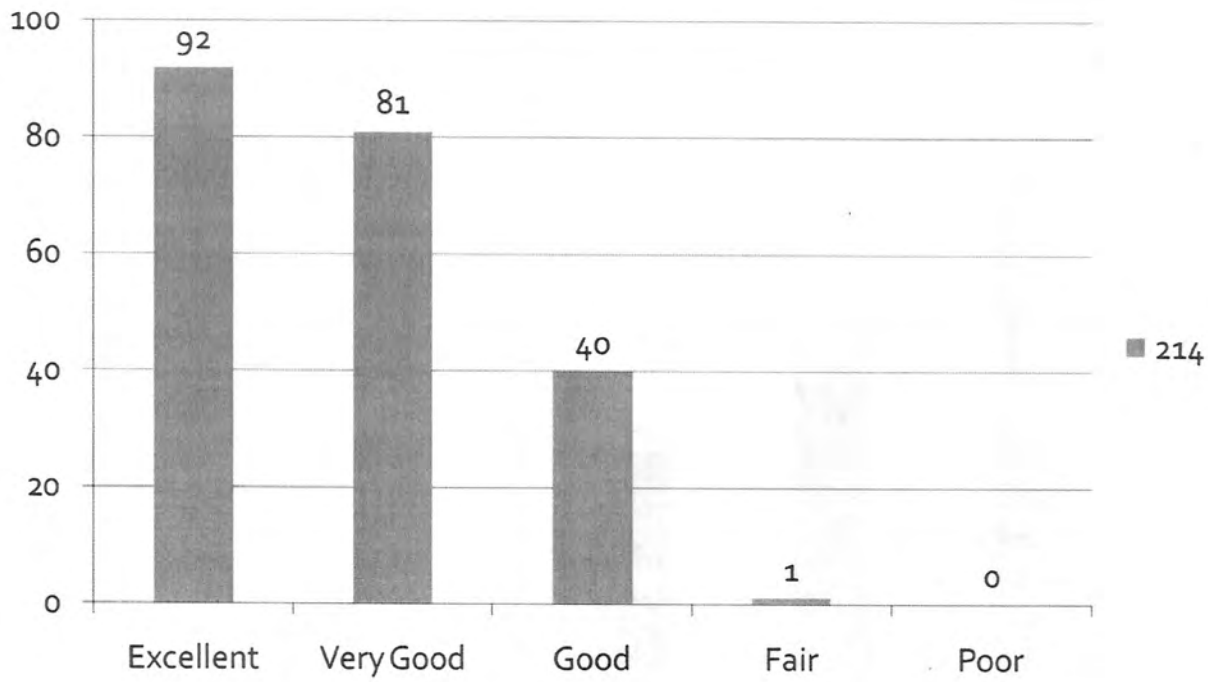


Figure 80

What is your overall evaluation of the CE activity?

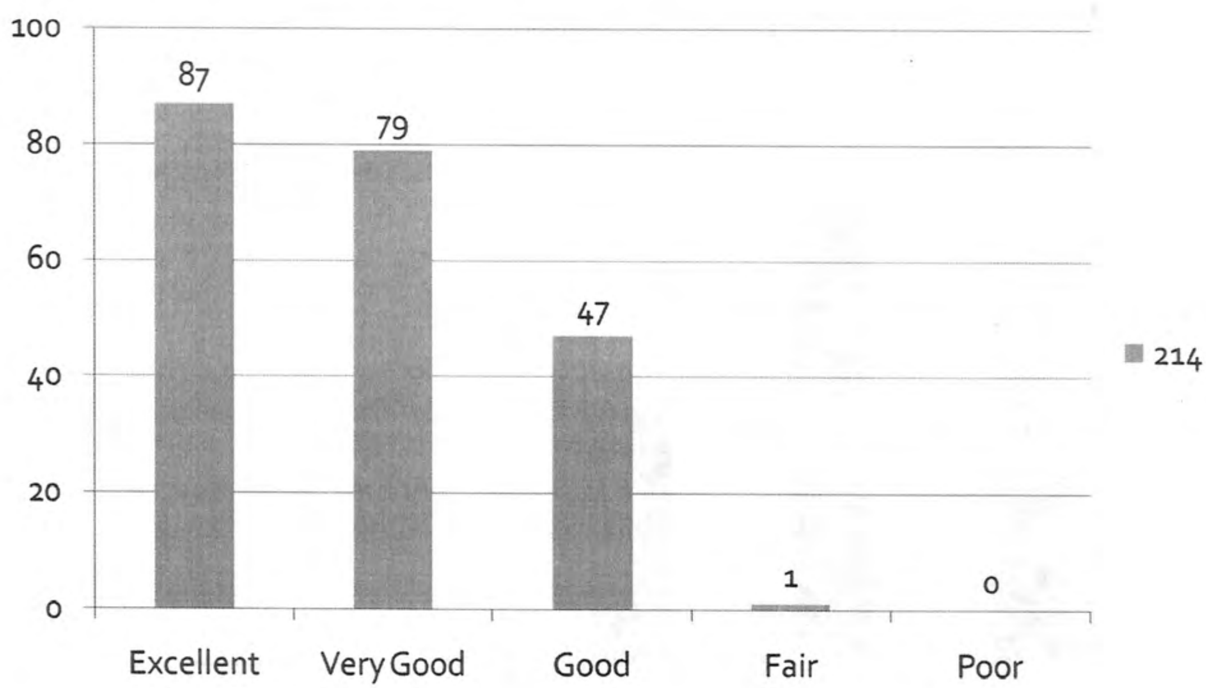


Figure 81

Did this CE activity meet the objectives?

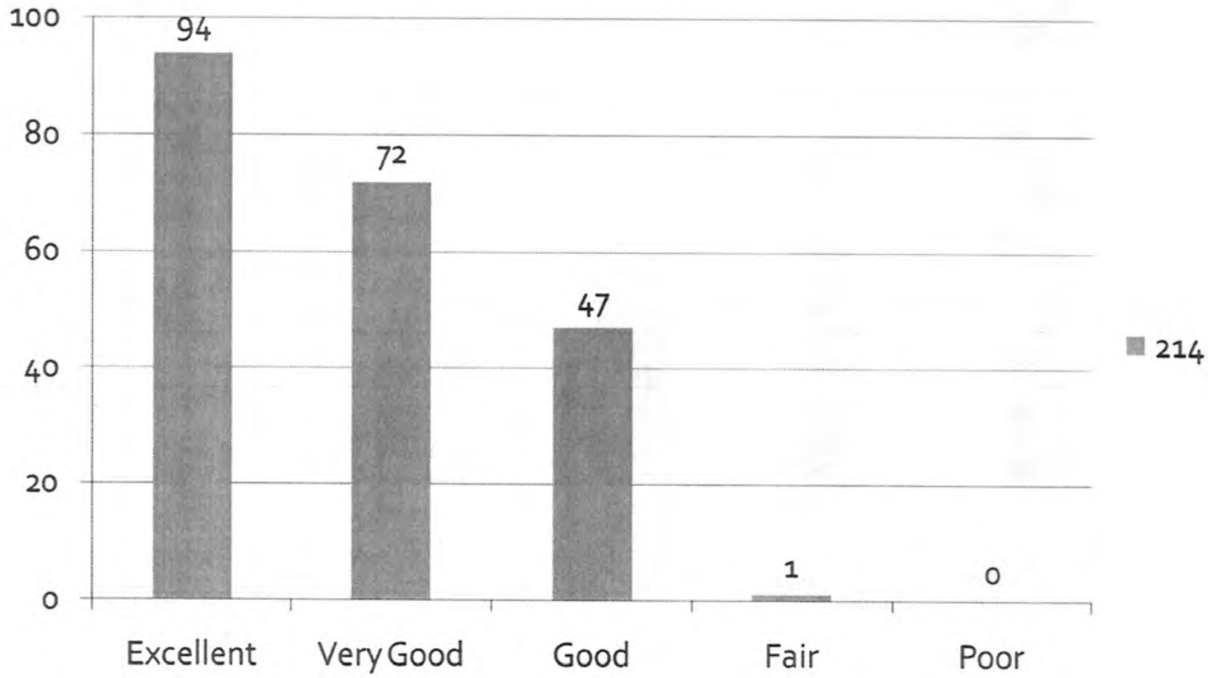


Figure 82

What is your evaluation of the CE activity content?

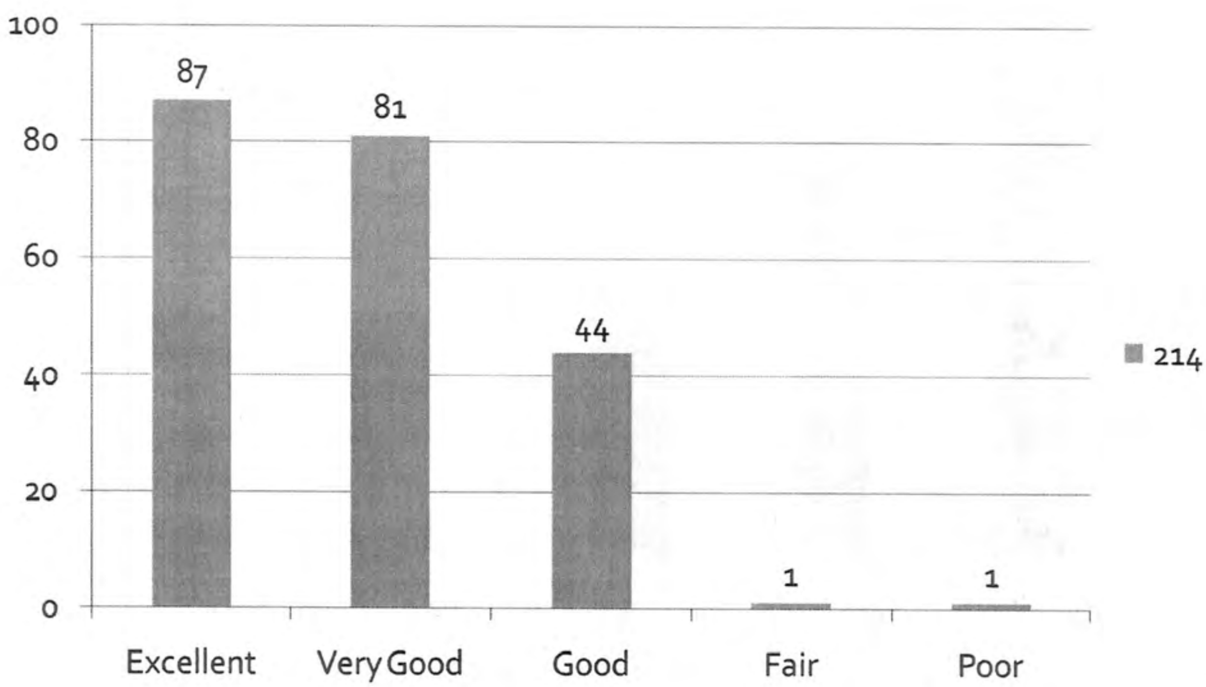
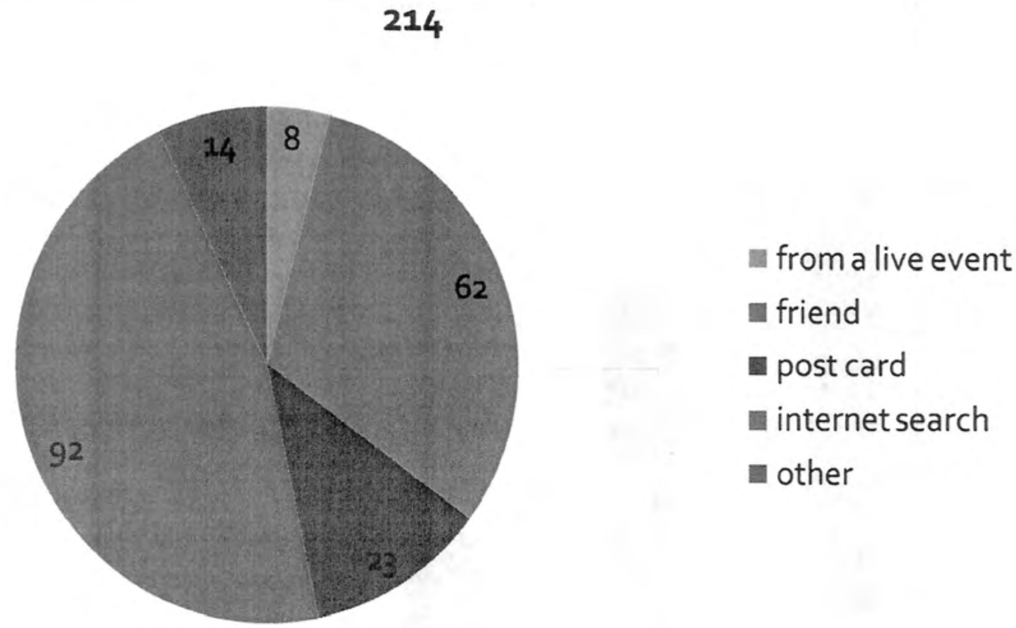


Figure 83

How did you find out about this monograph?



Better Than Counting Sheep: Treating Insomnia (online monograph)

Figure 84

Rate objective 1: Define the prevalence of insomnia and the estimated economic costs of insomnia in the United States.

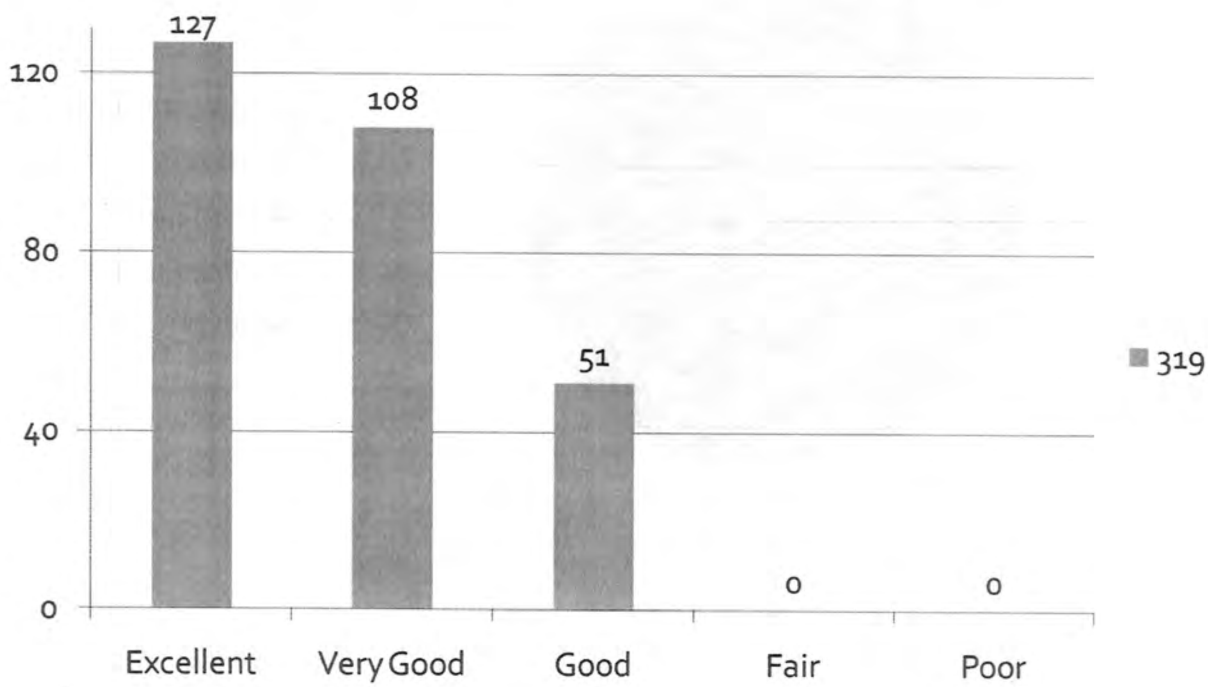


Figure 85

Rate objective 2: Describe the pharmacological approaches to the management of insomnia (short and long term) and their therapeutic mechanisms of action.

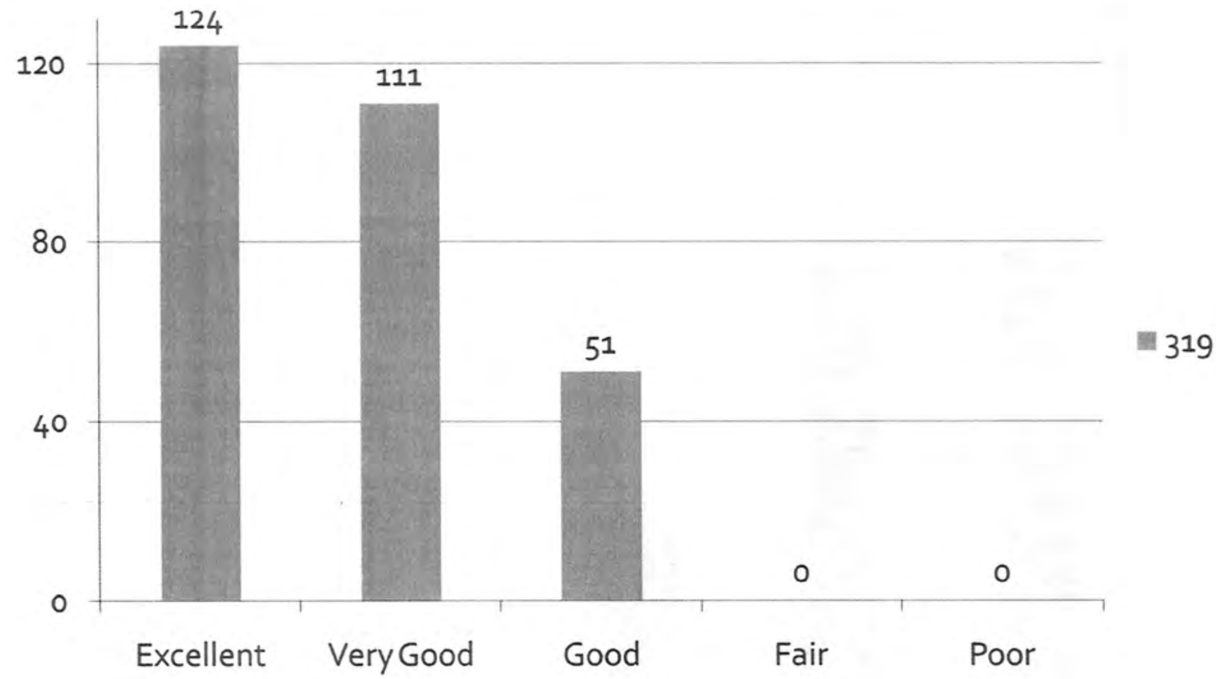


Figure 86

Rate objective 3: Describe the comparative efficacy, pharmacokinetics, and contraindications of agents used in the treatment of insomnia.

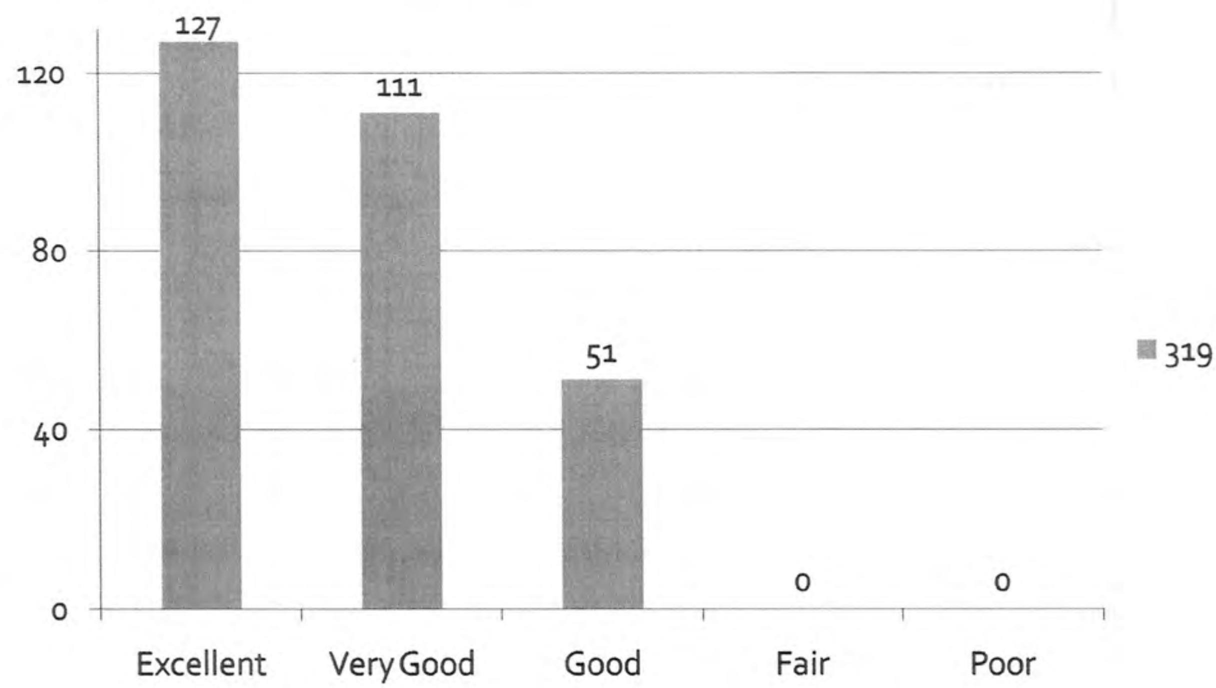


Figure 87

Rate objective 4: List strategies for pharmacists to educate and counsel patients on appropriate sleep habits.

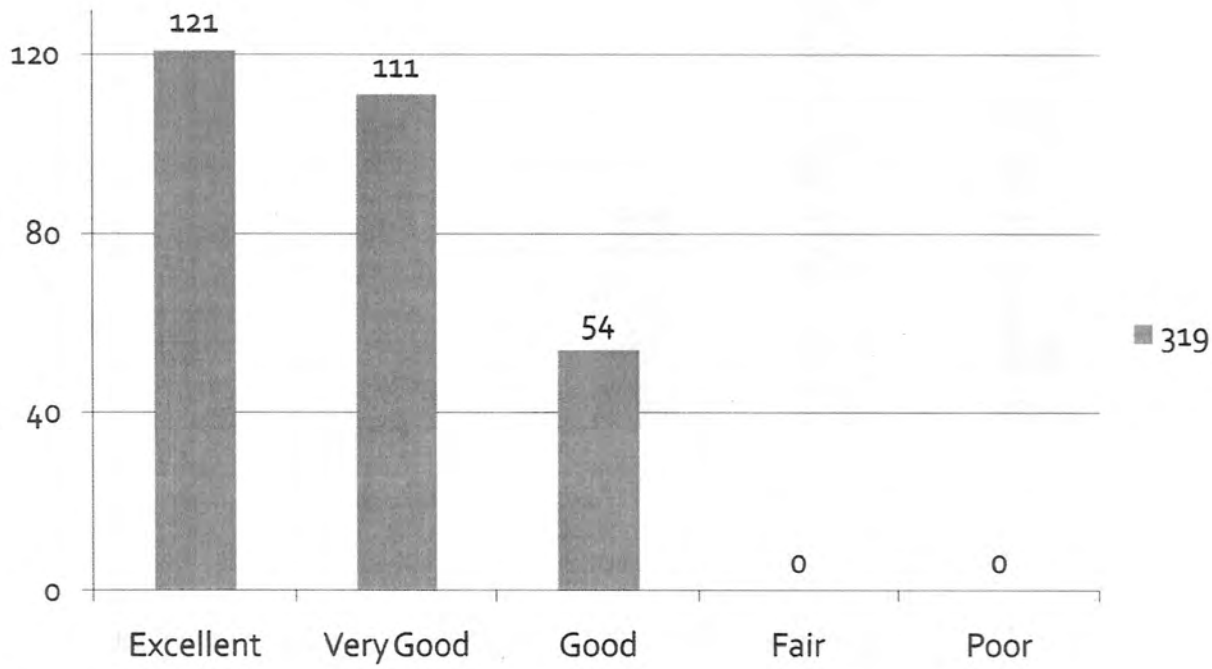


Figure 88

What is your overall evaluation of the monograph (article) and the exam?

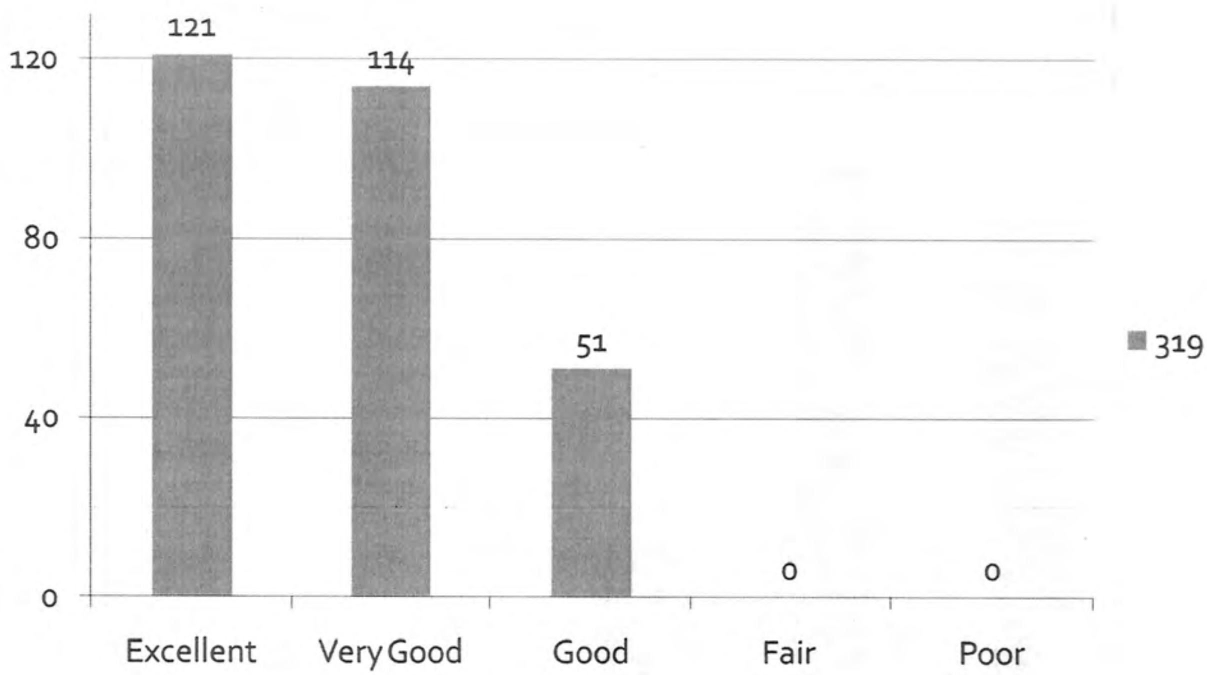


Figure 89

How well did this monograph (article) and exam meet the objectives?

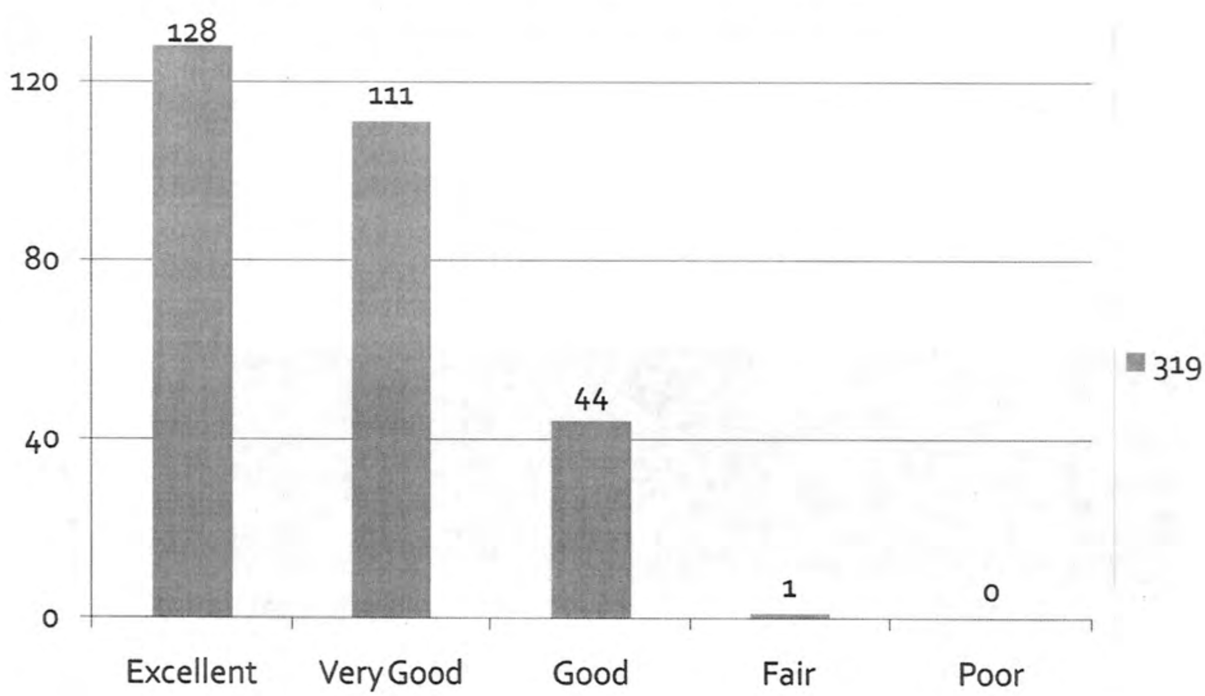


Figure 90

What is your evaluation of the monograph (article) content?

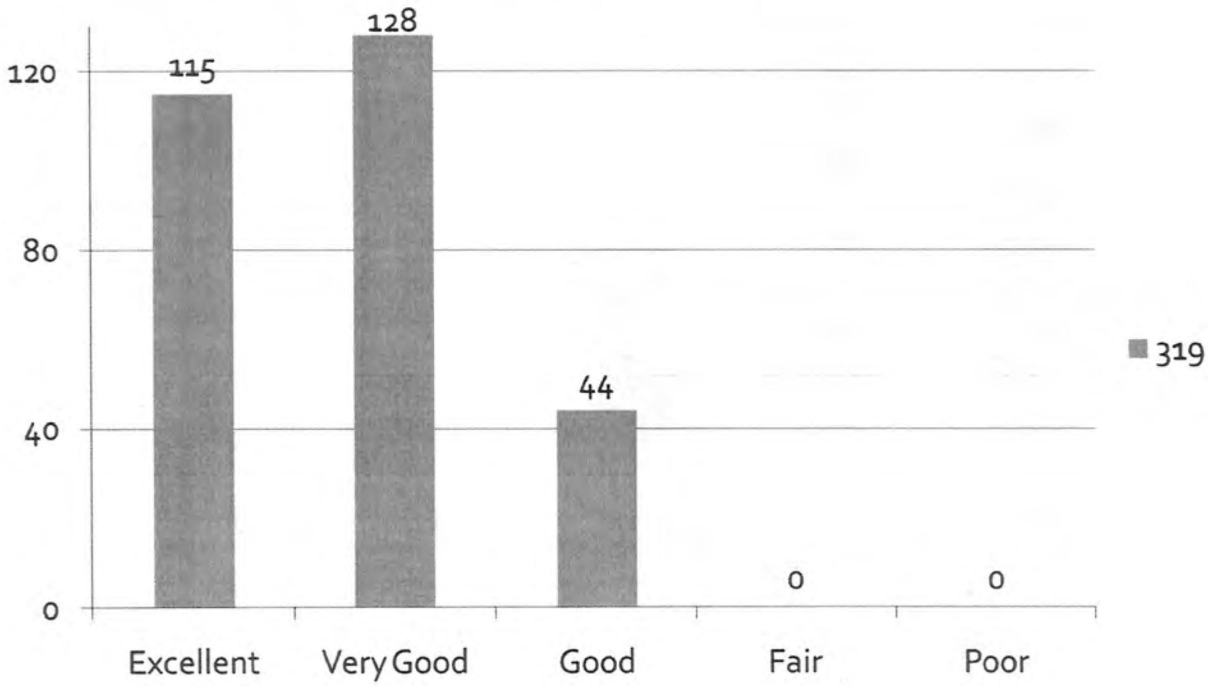


Figure 91

On a graded scale, did you perceive the presentation to be commercial or educational?

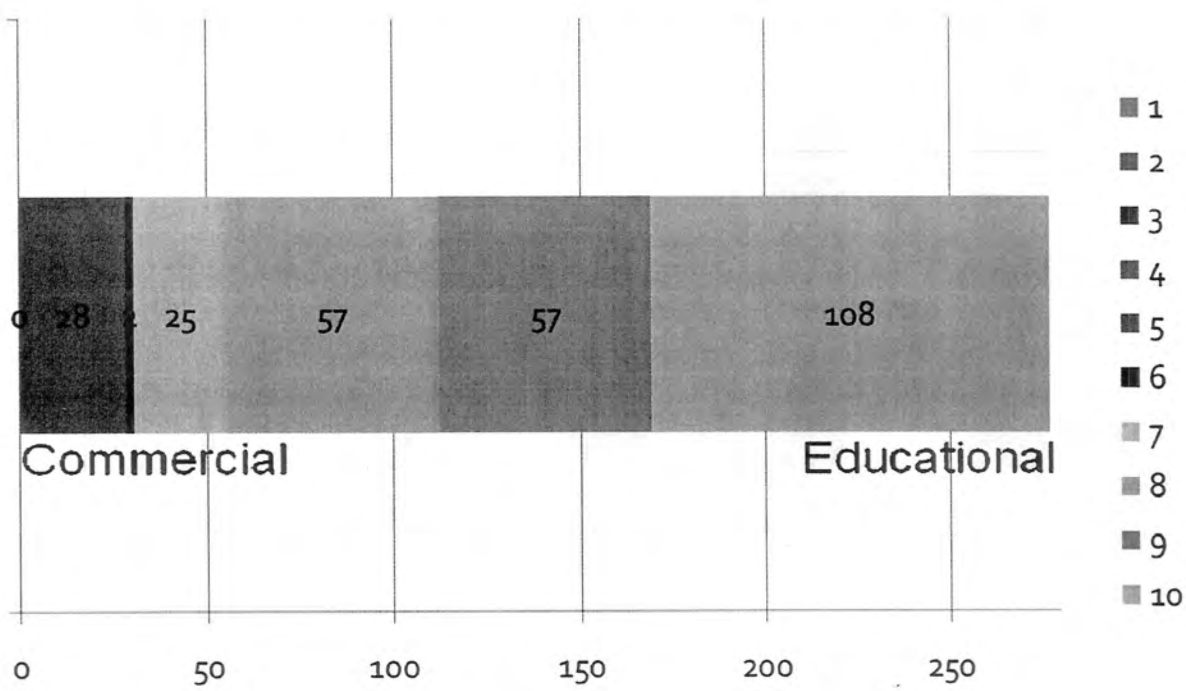
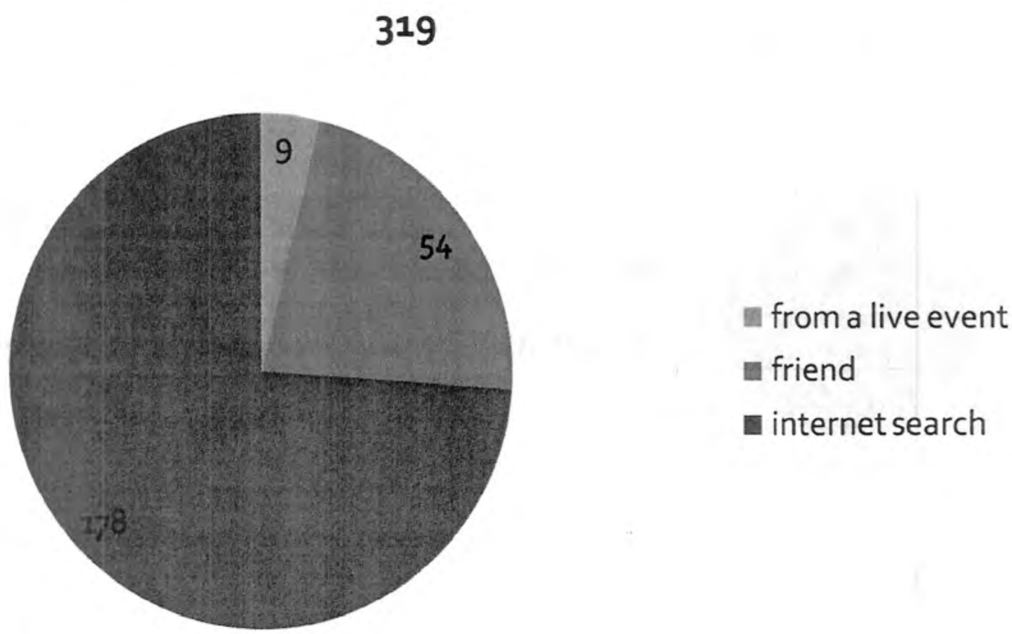


Figure 92

How did you find out about this monograph?



Native American Medicines (mailer monograph)

Figure 93

Age of Participants in the Learning Activity and Non-Learning Activity Groups

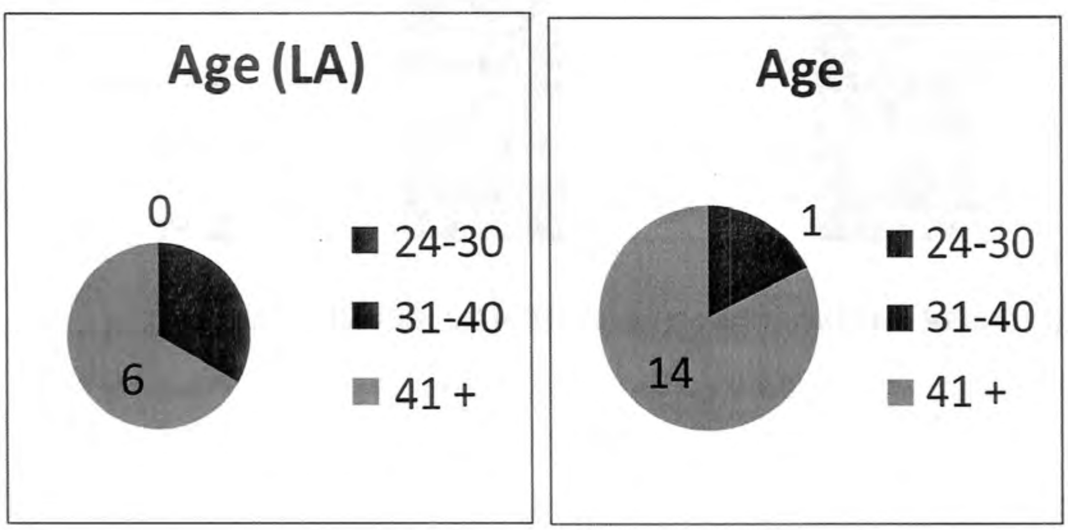
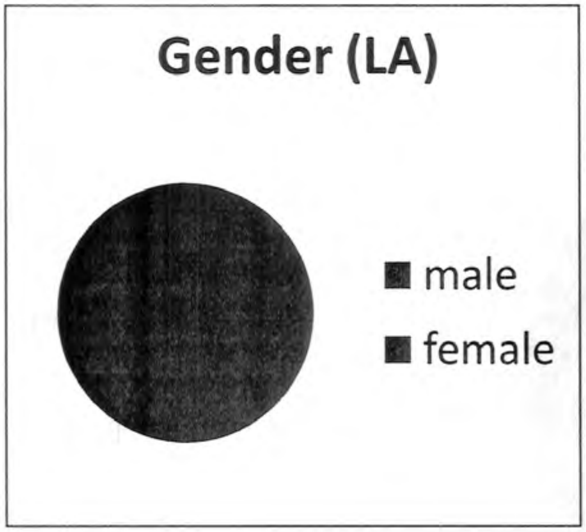


Figure 94

Gender of Participants in the Learning Activity and Non-Learning Activity Groups



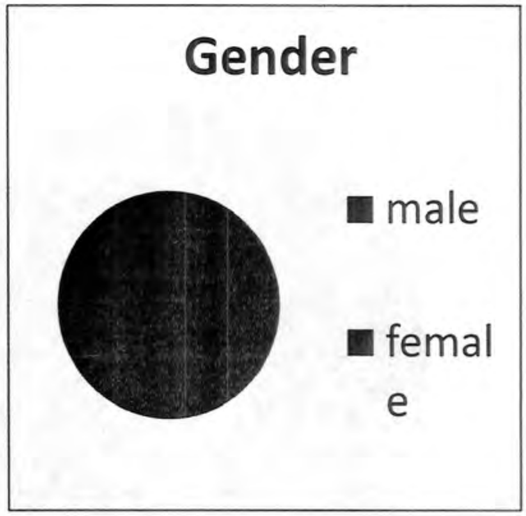


Figure 95

Rate the effectiveness of how the activity met the stated learning objectives

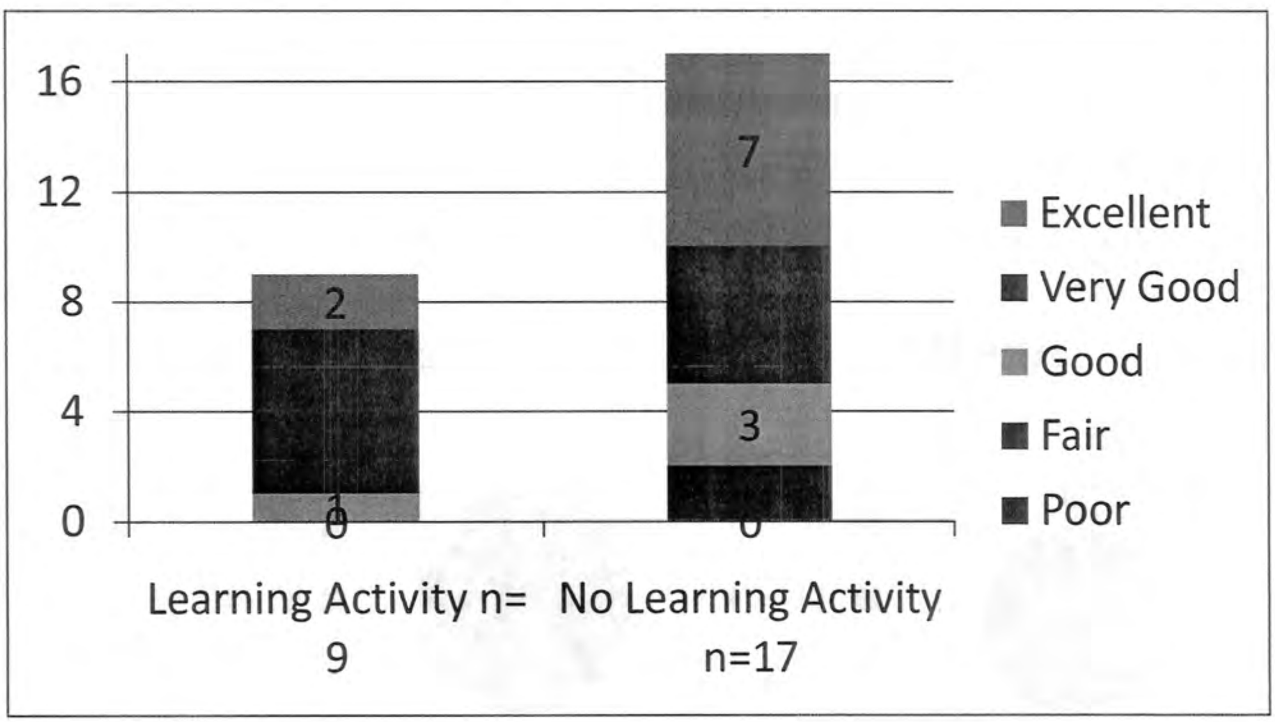


Figure 96

Rate the effectiveness of how the activity related to your practice needs

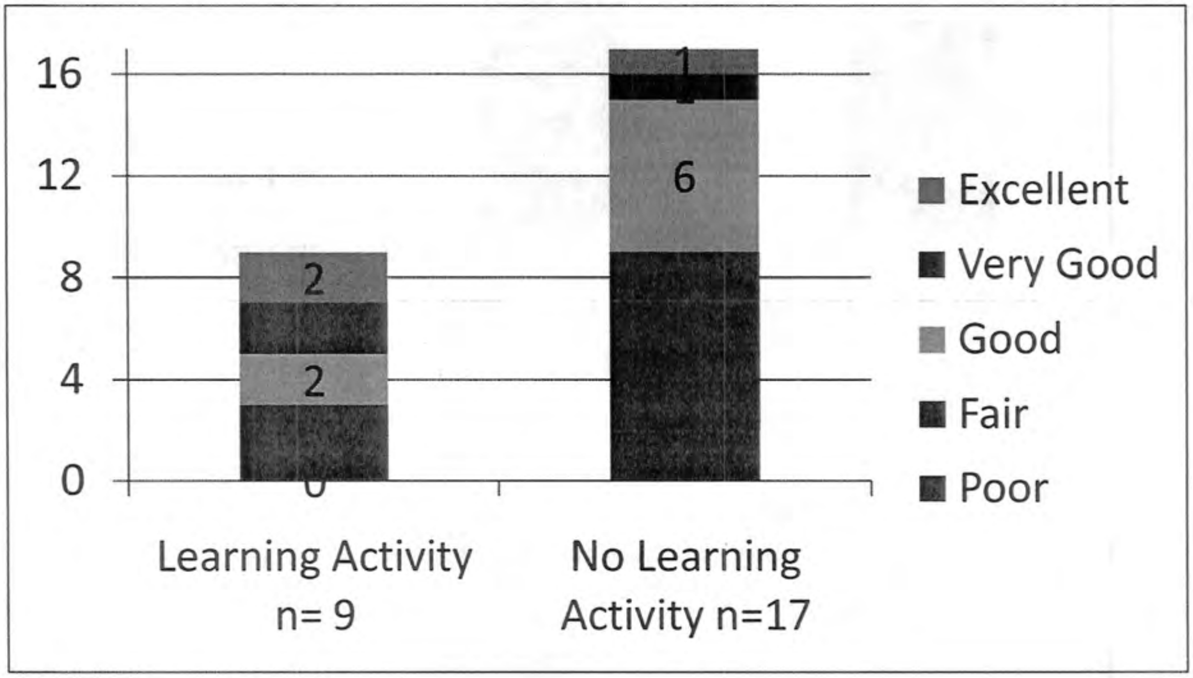


Figure 97

Rate the effectiveness of how the activity will help you improve patient care

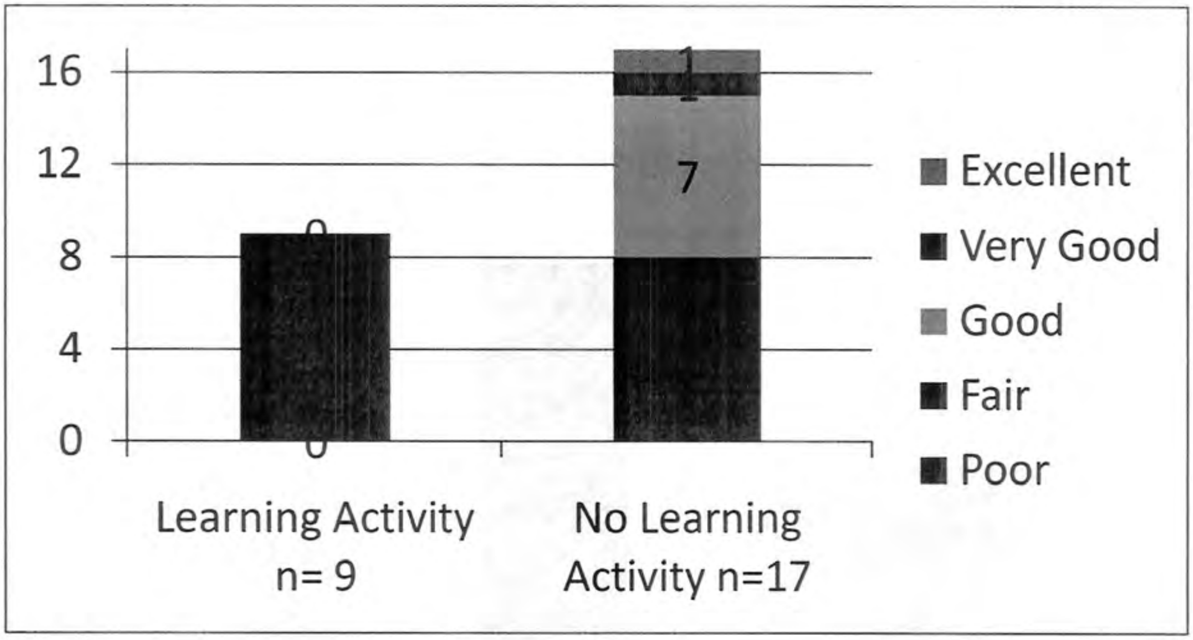


Figure 98

Rate the effectiveness of how the author conveyed the subject matter

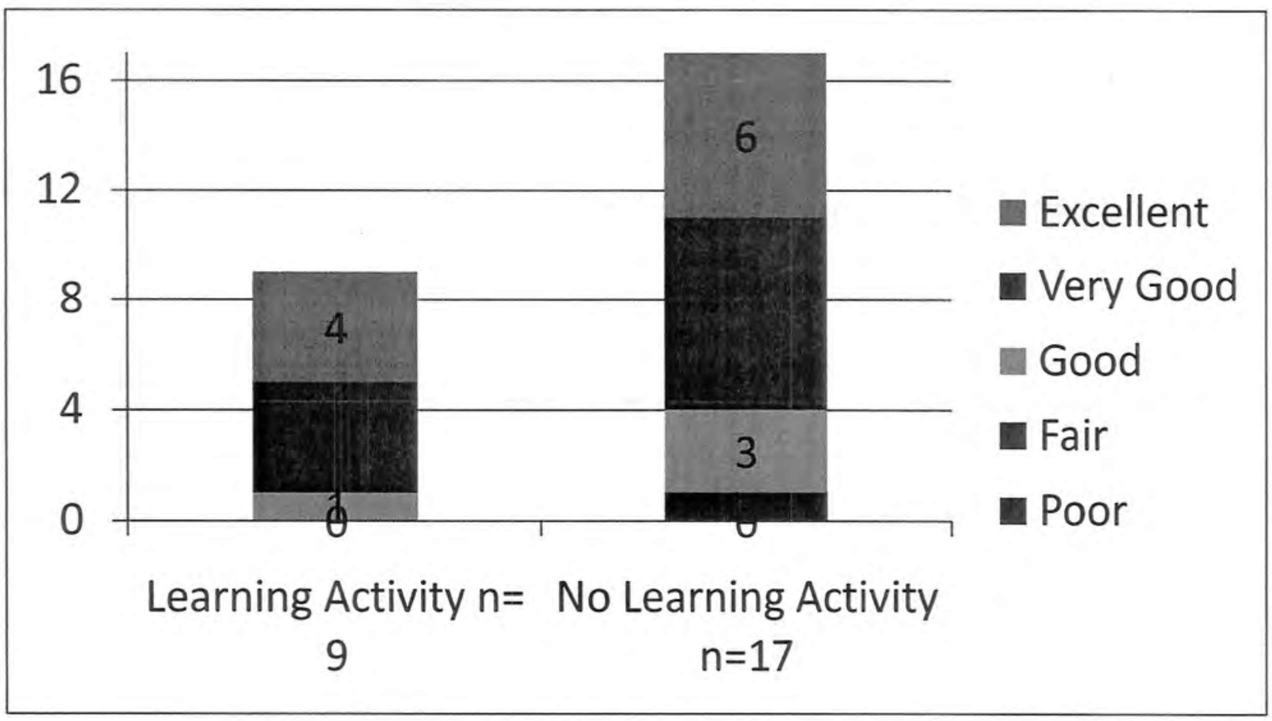


Figure 99

Rate the overall quality of the activity

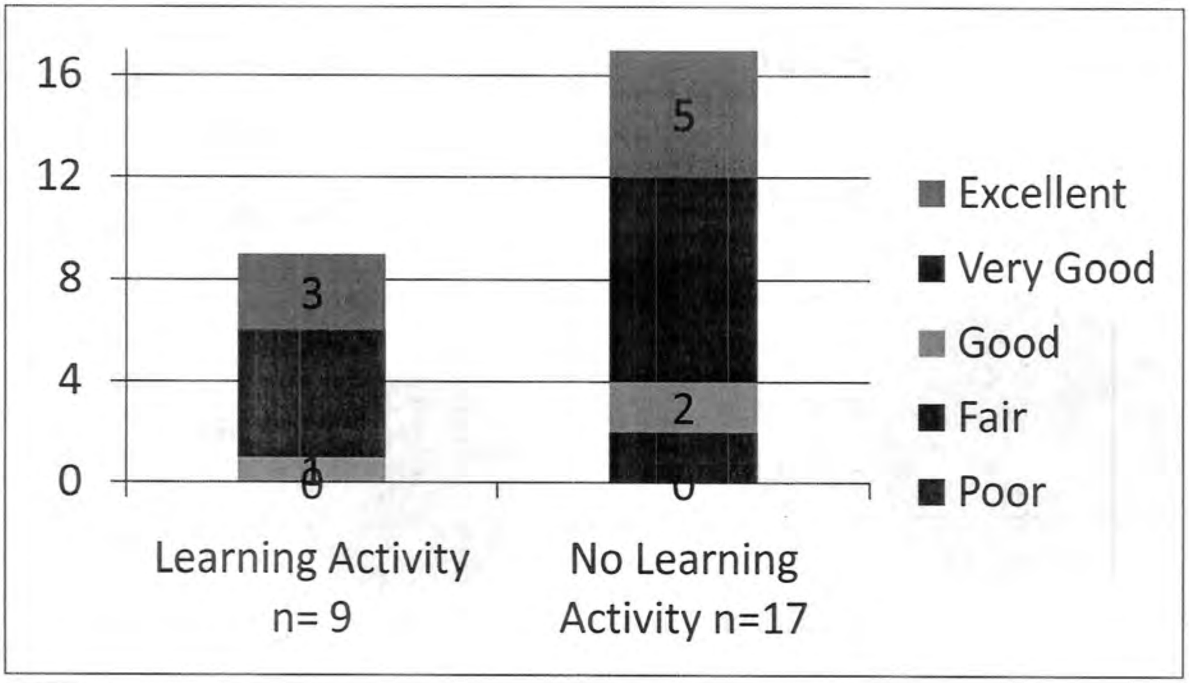


Figure 100

As a result of this activity, did you learn something new or verify important information you already knew?

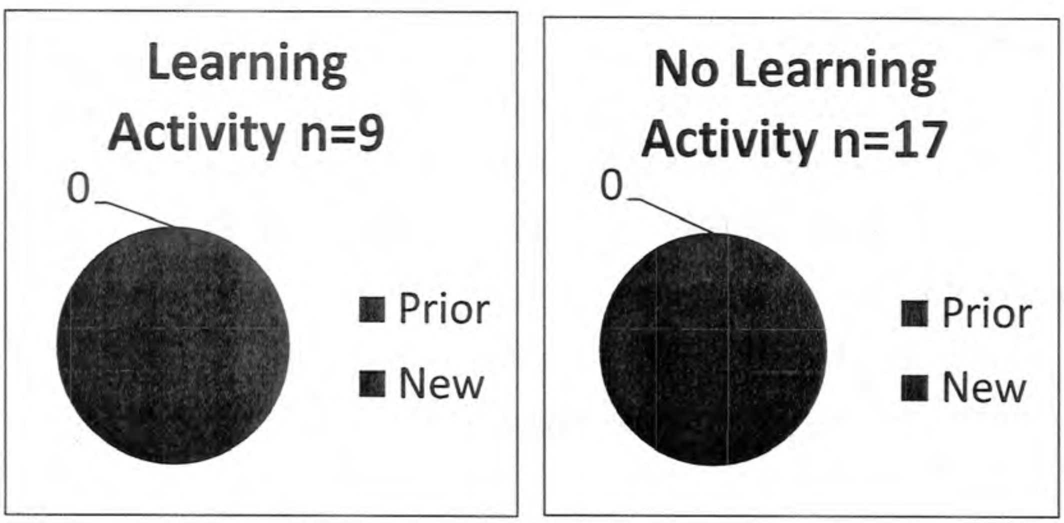
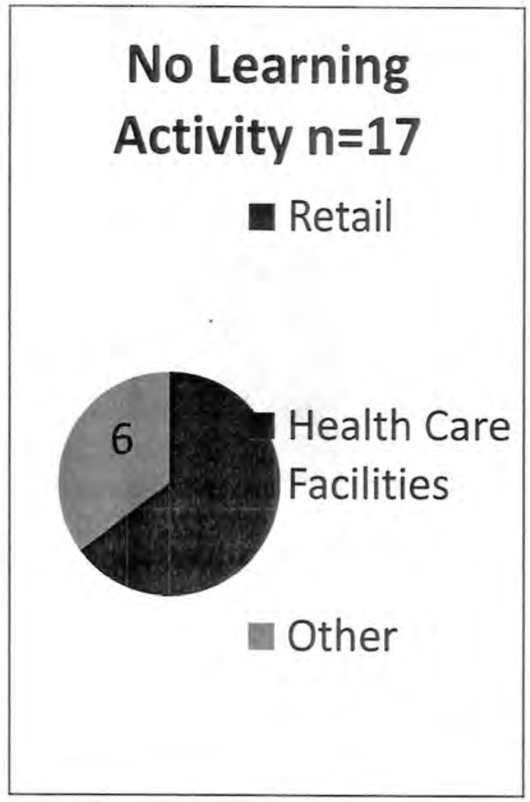


Figure 101

Please indicate your classification:



<u>What motivational factors helped you to complete an online course?</u>

- **Learning Activity**
  - It was a unique CE course, never saw one like this before.
  - I liked the crossword puzzle, it really helped to learn new meds.
  - I was motivated by the interesting subject matter.
- **No Learning Activity**
  - I like to learn new things, especially about natural medicines.
  - Topic is interesting and is different material.
  - It is free.

<u>What is the best time of year to participate in continuing education and why?</u>

- **Learning Activity**
  - Fall, winter (less outdoor activities and more time indoors)
- **No Learning Activity**

- Fall, winter (less outdoor activities and more time indoors)

Smoking Cessation (mailer monograph)

Figure 102

Age of Participants in the Learning Activity and Non-Learning Activity Groups

Figure 103

Gender of Participants in the Learning Activity and Non-Learning Activity Groups

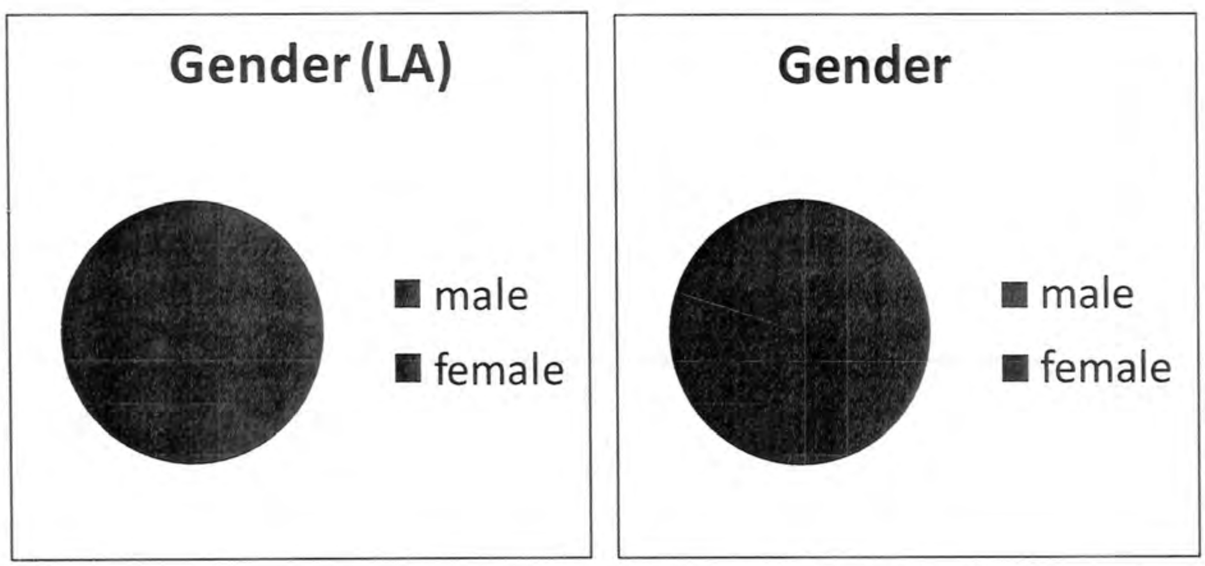


Figure 104

Rate the effectiveness of how the activity met the stated learning objectives

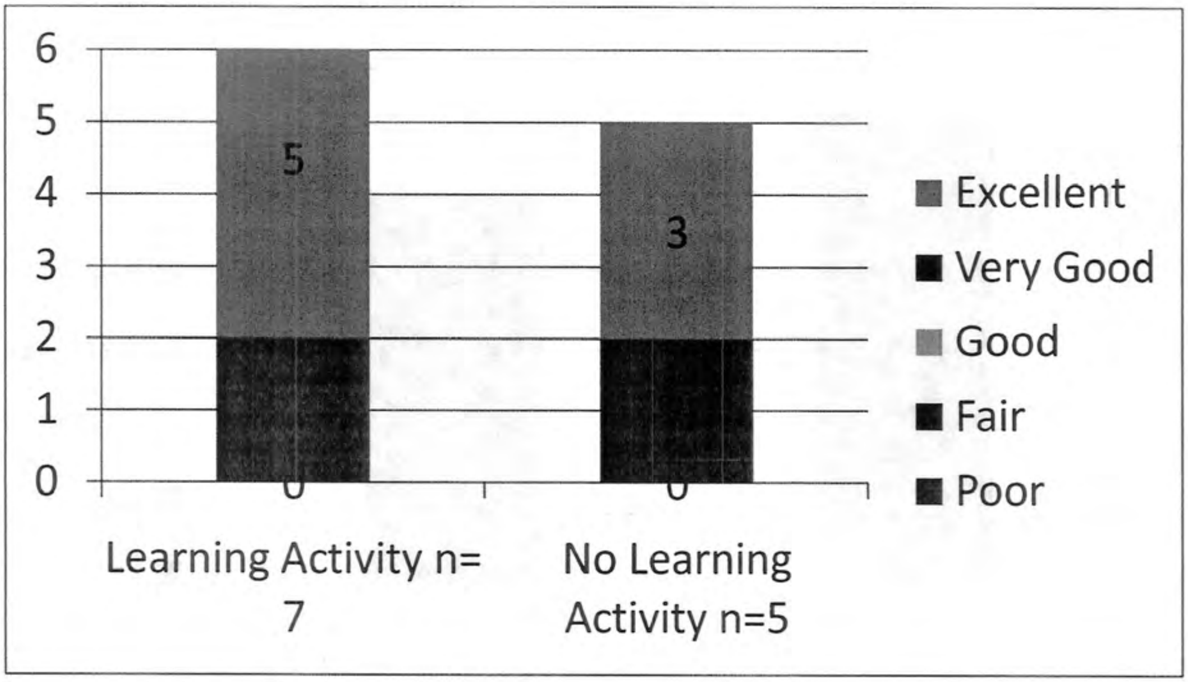
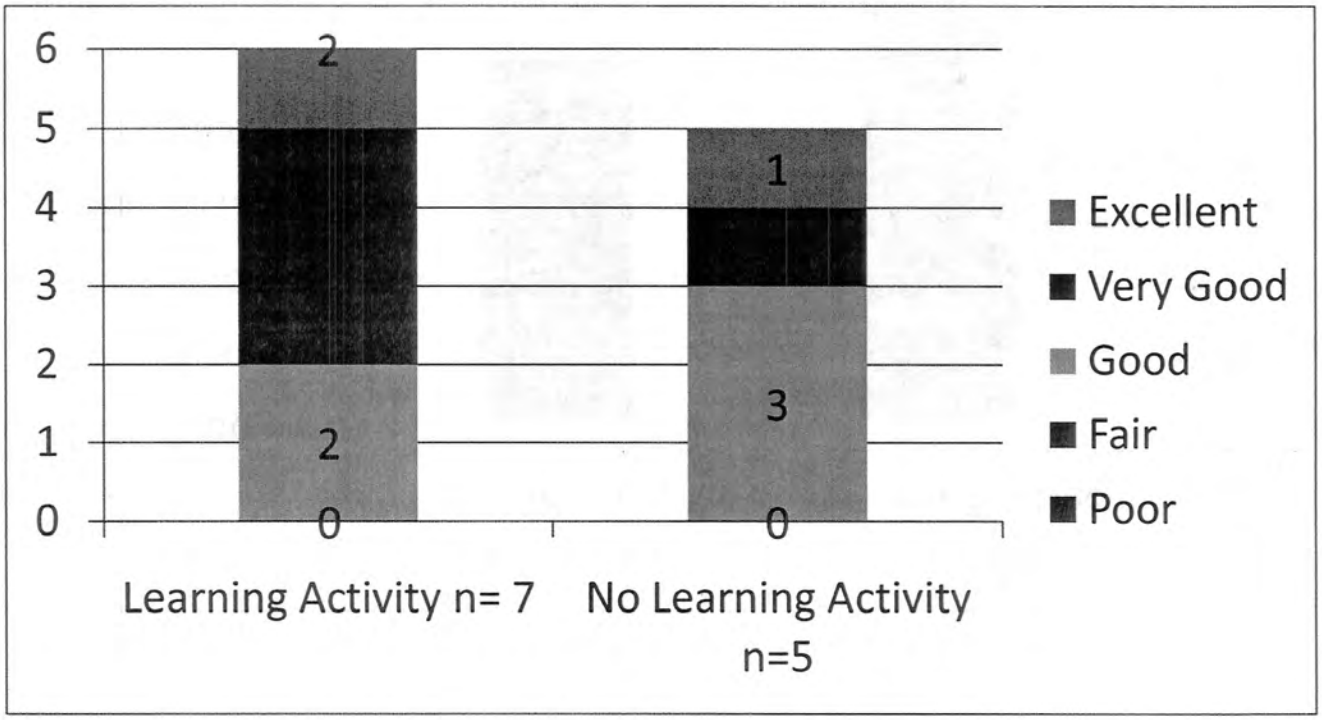


Figure 105

Rate the effectiveness of how the activity related to your practice needs



6
5
4
3
2
1
0
2
2
0
1
3
0
Excellent
Very Good
Good
Fair
Poor
Learning Activity n= 7
No Learning Activity n=5

Figure 106

Rate the effectiveness of how the activity will help you improve patient care

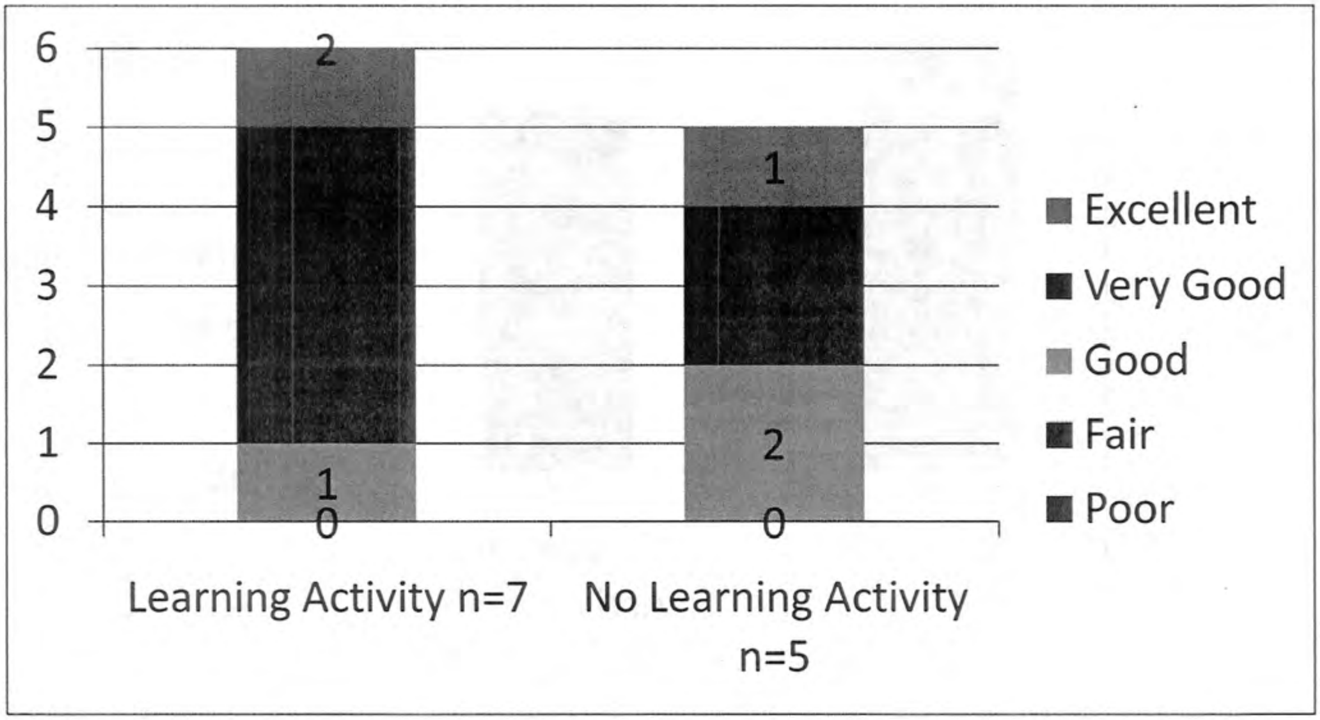


Figure 107

Rate the effectiveness of how the author conveyed the subject matter

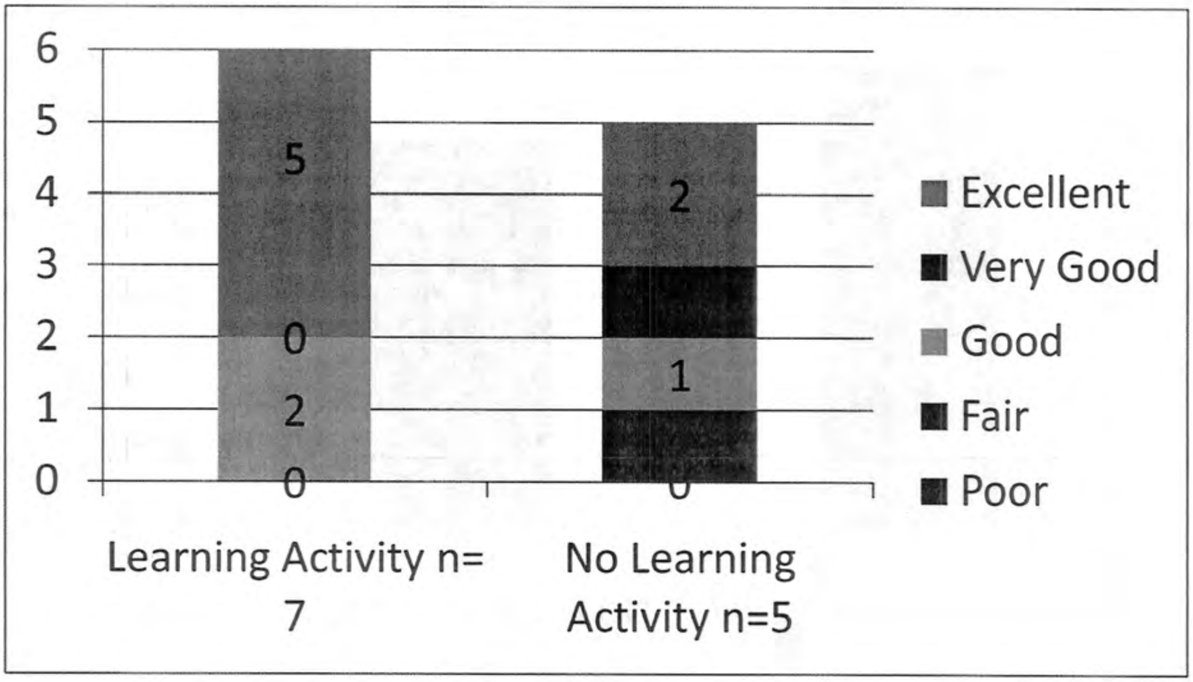


Figure 108

Rate the overall quality of the activity

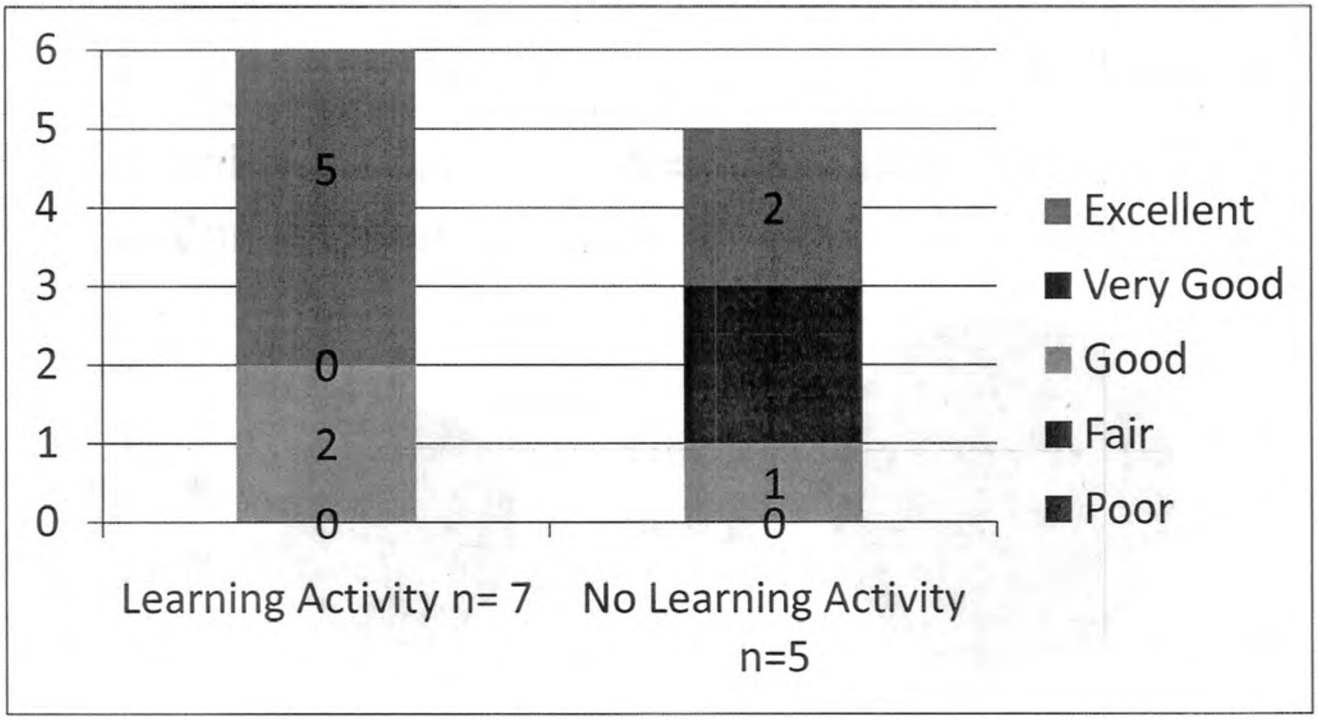


Figure 109

As a result of this activity, did you learn something new or verify important information you already knew?

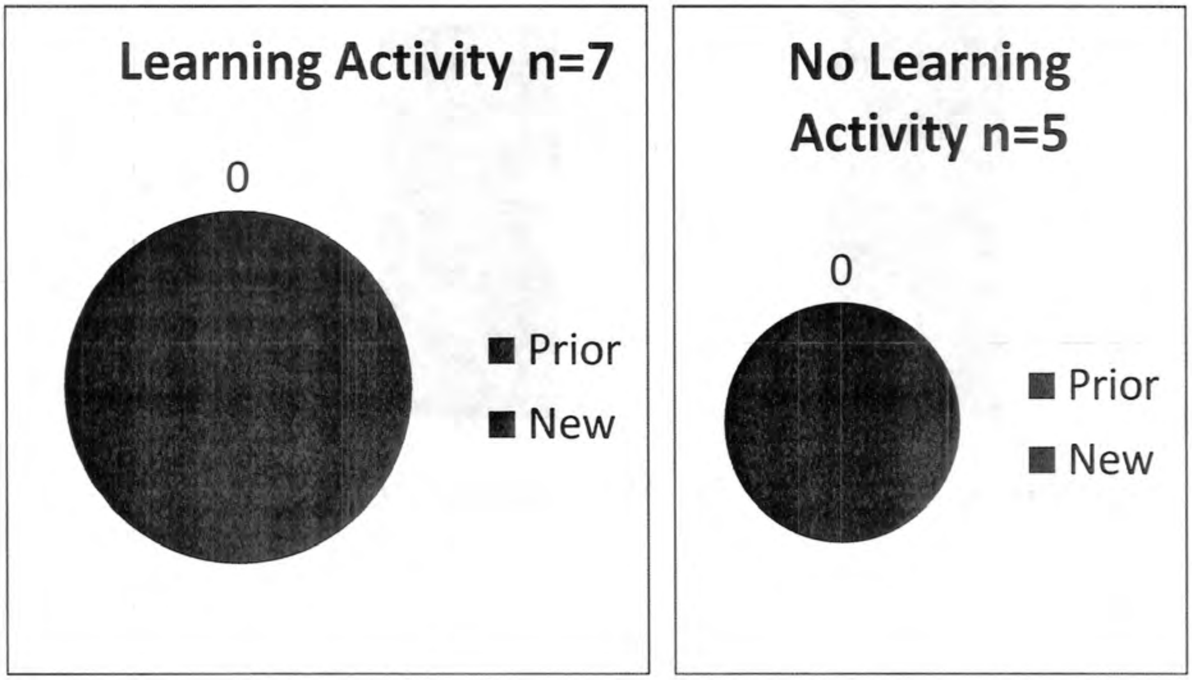


Figure 110

Please indicate your classification:

<u>What motivational factors helped you to complete an online course?</u>

- **Learning Activity**
  - I like to learn new things.
  - The program was presented well.
  - Interesting subject.
- **No Learning Activity**
  - Need the CEUs.

<u>What is the best time of year to participate in continuing education and why?</u>

- **Learning Activity**
  - Fall, winter (less outdoor activities and more time indoors)

- **No Learning Activity**
    - Winter (more time to do CEs)

Saint Francis University's Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Specialized Medical Training for Rural Medicine

Protocol No.: 05-TATDL203-05

Date: March 12, 2008

Protocol Title: Specialized Medical Training for Rural Medicine

Principal Investigator: Kristine M. Anderson

Protocol Executive Summary:

This research study examined the affective response of students that interacted with emerging methods of using technology in learning and instruction in medical education. The study explored how the technology can make an effective educational impact that achieves high levels of cognitive attainment when utilizing the technology. The study accomplished the following project goals, also known as study objectives, of defining and researching the enactment of various pedagogical theories of effective medical education in rural and medically underserved areas, researching the technological appropriateness of medical training in rural and medically underserved areas, and researching future technologies that have the potential for delivering education to rural medical professionals. The study researched the following specialized medical topics and educational technology scenarios.

The effective use of handheld devices was researched with these devices: the Apple iTouch, Apple iPod, Archos 604WiFi, Creative Zen M, Palm T/X, and a portable DVD player. The handheld devices were loaded with multimedia content pertaining to diabetes, amputation, physical therapy, and patient management techniques for physical therapists. The technical summary and capabilities of each device, content and production experiences with each device, and student affective responses when interacting with the devices are reported.

The next technical method of instruction that was researched is the virtual case study. These are video patients that a student can interact with by choosing questions or examination procedures to conduct and then providing a diagnosis or other essay responses that can be used for evaluation. The effective use of streaming technologies and instructional topics were researched and developed as part of the software package. The technical development summary of the software, technical expert experiences, and implications of the case study software are reported. The final method researched was the use of virtual skills assessment. The medical profession of physical therapy requires a high level of provider-patient interaction that can be cumbersome and nearly impossible to adequately evaluate, especially to engage in the topic with students during the full curriculum of a class in a semester. The technical requirements of conducting virtual skills assessments, insight of the course instructor utilizing the method, the affective response of the students using the technology, and the potential benefits, are reported.

The study results and implications have been presented at the 2007 Showcase for Commerce in Johnstown, Pennsylvania, the 2007 Armstrong Technology Exposition in Armstrong, Pennsylvania, and the international 2007 EDUCAUSE conference in Seattle, Washington. It has also been accepted at the 2007 Adult Education and Communications Technology conference in San Francisco, California, the 2007 Education and Information Systems, Technologies and Applications conference in Orlando, Florida, and the 2008 American Telemedicine Association conference in Seattle, Washington. From January to March 2008 the investigator will seek educational science journals and industry magazines for article publication.

Introduction:

The study's objective has been to provide effective methods of learning that apply instructional design, as appropriate in the learning environment, to increase knowledge, and apply educational training to medical professionals in rural and underserved areas. The study identified areas in medical physical therapy education that lacked the necessary training. Specifically, these areas are amputation care and treatment, pediatric gait assessment and interventions, and proprioceptive neuromuscular facilitation.

The first of the medical topics addressed in the study is: amputation care and treatment. This study will make a difference by addressing the reality of war. Currently, 28% of United States amputees are from the Iraq and Afghanistan wars (Moniz, 2005). In pale comparison, only 10% of American civilians have an amputation (Moniz, 2005). This doubling of amputees entering American healthcare has caused a strain on medical professionals needing additional training and exposure on the care and treatment. By working with rural physicians, orthopedic therapists, physical therapists, university instructors, Iraq and Vietnam veteran amputees, their families, and the National Naval Medical Center in Bethesda, Maryland, this study is developing holistic continuing education for rural medicine and researching the distribution of this knowledge on handheld technologies. The development of this education was delivered to currently enrolled medical students in the physical therapy program at Saint Francis University, a rural school located in Western Pennsylvania.

The next topics researched in the study were pediatric gait assessment and proprioceptive neuromuscular facilitation. There is an increasing prevalence of neurological and neuromuscular disorders in the United States (Newschaffer, Falb & Gurney, 2005). The therapeutic management of pediatric clients with neuromuscular disorders such as Muscular Dystrophy and Down Syndrome can be a complex treatment regiment for patients and physical therapists. Also, the interventions and sensory treatments of neurological disorders such as stroke, Asperger's, brain injury, and Epilepsy can be a complex treatment regiment for patients and physical therapists. The study sought to improve the training and evaluation of these topics with students in the academic classroom. By working with currently practicing physical therapists, physicians, university instructors, and instructional designers the study developed a comprehensive method of effective training and evaluation that encompasses the use of emerging technology.

The case study software will be implemented and researched with students and instructors in FY07 in these studies: Massed vs. Distributive Practice: Assessing Sustained Cognitive Performance, and the Specialized Medical Training for Rural Medicine. The case study software will also be investigated for development as a commercial service for instructors wishing to pursue a case study method of learning in their curriculum.

Methods:

The research methods implemented in the study are a triangulated analysis among the research questions posed. This investigation consists of a review of pedagogical theories and literature, student affective assessments, instructor feedback and analysis, and the technical review of emerging technologies for education. Several procedures were implemented to conduct the quantitative and qualitative data analysis of each method.

The first research question asked to define and research the enactment of various pedagogical theories of effective medical education in rural and medically underserved areas. A review of the literature was conducted to identify effective pedagogical theories to implement in the study. The description of each of these theories and the resulting research implications from applying them in the study is defined. This qualitative analysis was defined by the identification of the guiding concept of seeking educational theories of instruction with technology for effective medical education training.

The second research question asked to research the technological appropriateness of medical training in rural and medically underserved areas. This research questions were explored by conducting affective assessments with the subjects that participated in the study. (These assessments can be found in the Appendices.) After a subject completed an educational event in the study, an affective assessment was completed to gather the subject's thoughts and opinions regarding the technology and instructional intervention. The measurement of the outcomes of the assessments was analyzed by descriptive statistics. The most significant measure of central tendency is used to describe the results. A description of the frequency distribution and a graph for each is reported in the results and analysis section.

The third research question asked to research future technologies that have the potential for delivering education to rural medical professionals. A focus group of technical and instructional subject matter experts experimented with the technology to make recommendations of the emerging technologies to be used in the study. A report of the make-up of this panel, a description of the technologies used in the study, and the implications for future research was conducted and found in the next section.

Results and Analysis:

The first research explored asked to define and research the enactment of various pedagogical theories of effective medical education in rural and medically underserved areas. A review of the literature identified two effective pedagogical theories to implement in the study. They are the case study method of learning and the interactive method of learning.

The case study method of learning implements technology as a catalyst for change in classroom processes. The theory implements Jerome Bruner's cognitive psychology theory of scaffolding learning experiences for a more eclectic set of learning activities that include knowledge-building situations for students (Sandholtz, Ringstaff, & Dwyer, 1997). The case study method of learning permits a student to "stand in the shoes" of a practicing medical provider in a secure environment where any wrong decisions will not harm an actual patient. It is an interactive environment that can be implemented using technology and delivering effective training. Several schools such as Harvard Business School in Boston and the Darden School of Business at the University of Virginia have been dedicated to this instructional approach in their curriculum for several years (Stephenson, 2008).

The interactive method of learning builds upon the case study method of learning in that it is student-centered learning. The content or activities should be independent, cooperative and project-based learning opportunities (Land & Jonassen, 2000; Johnson, Schwab & Foa, 1999). This approach to instruction and learning is based on the constructivist learning research of John Dewey, Jean Piaget, and Lev Vygotsky (Zurita & Nussbaum, 2004; Phillips, 2006).

Instructors may struggle with meeting the diverse needs of students as they begin integrating technology into different areas of study. Direct instruction in the physical therapy classroom was holding the students back from an interactive method of learning and a paradigm shift was needed. Methods such as independent, cooperative, and project-based learning opportunities are needed for students to be active rather than passive learners. (Land & Jonassen, 2000; Johnson, Schwab & Foa, 1999).

The physical therapy class was an excellent pool of study subjects since they will encounter the growing number of amputees from the Iraq war and will encounter the growing numbers of neuromuscular disorders such as patients with Autism. Both of these patient populations require extensive physical therapy rehabilitation. The physical therapy curriculum requires more education on diagnosis and treatments. The study's implementation of the handheld and video technologies was the first time that elements like this were implemented in their curriculum. The case study method of learning and interactive method of learning are a knowledge-building situation that has been around in a text form for some time. The electronic presentation of a case study not only provides an interactive environment but is also a safe environment. The case method presents a solution to giving medical professionals a hands-on approach to gaining experience with treatments of people in special populations. This method was explored in the study by developing content on Internet case studies, handheld media, and video skills assessments.

The second research question asked to research the technological appropriateness of medical training in rural and medically underserved areas. This is reported below for the case study, handhelds, and video assessments implemented in the study. Where indicated, the most significant measure of central tendency is used to describe the results, along with pictures, frequency distribution and graphs where necessary.

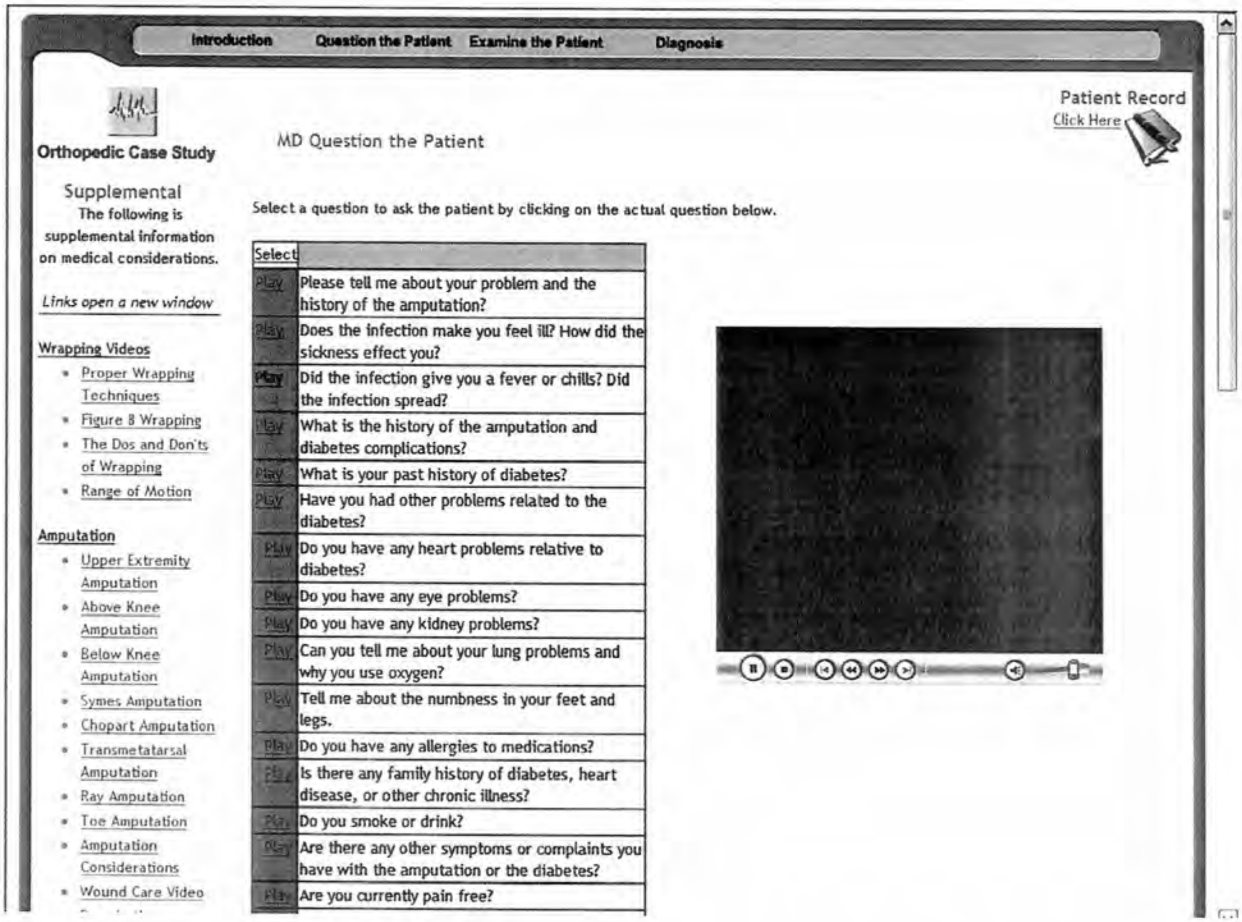
One of the hardest tasks of a medical provider is to correctly diagnose and treat medical conditions. In clinical practice, they must gather all of the inhibiting and limiting factors to determine the cause of the problem and treat the problem. In an effort to combine both the cognitive and clinical aspects of this learning situation, the study developed web-based case studies. These case studies have been developed to give the students a realistic opportunity to apply their skills of diagnosing and treating patient's medical problems in a secure environment where wrong judgments will not have a life threatening or negative effect on the patient. The development of the virtual case study permitted didactic text-only case studies to be re-formed into dynamic multimedia learning experiences that can be distributed online. The case studies began a new pedagogic route into the medical considerations of complex medical situations. In the case of teaching amputation care, the distance learning team investigated the cause, effect, and lifelong medical needs of post-war amputees. The team began the investigation by a series of interviews to explore into the phenomenon. The persons interviewed were a military orthopedic surgeon, military physical therapist, rural family physician, rural physical therapist, distance learning researcher, and Iraq and Vietnam veteran amputees. Their stories combined with live footage of these medical professionals at work produced a video that tells the story of the challenges returning amputees face after leaving the military and solutions CERMUSA proposes to help them face these challenges (This video is available for viewing). The research collected from these interviews developed the topic for the first case study for use with medical professionals seeking medical education on what is to be expected a growing topic of concern. This case study produced best practices in video production, web development, and explored display mediums and learner interaction.

Streaming media technology emerged as the web evolved from static to dynamic content. There are two types of streaming: true streaming uses RTP and RTSP (Real Time Protocol and Real Time Streaming Protocol) as the transport protocols, and there is a dedicated server where the source (multimedia files or live broadcast) is transmitted and viewed by the client. Progressive Download uses HTTP (Hyper-Text Translation Protocol) as the transport protocol, with a regular web server. In this method, a portion of the video is downloaded onto the client's storage and begins playing before it is completely loaded. The study used a progressive download to compress and encode on the server end and then decompress and decode by a Windows Media player on the client side. It was found that either type of streaming or multimedia source requires a scalable and efficient server with a fast storage solution and good network bandwidth to address the needs of streaming media applications (Jacob & Kishore, 2002).

The streaming usage of students using multiple instructional venues was examined by in-house research and a literature review of current studies in the field of educational research as they apply in rural medicine. The in-house testing found that learners are able to receive and send their solutions to the case studies wirelessly while an instructor has immediate access to their learners. Streaming media on handhelds also provides a viable way to manage information technology resources allowing for mobility while learners experience having an intensive learning environment on medical education. These benefits should lend to a greater involvement in the educational atmosphere and preparation of learning materials.

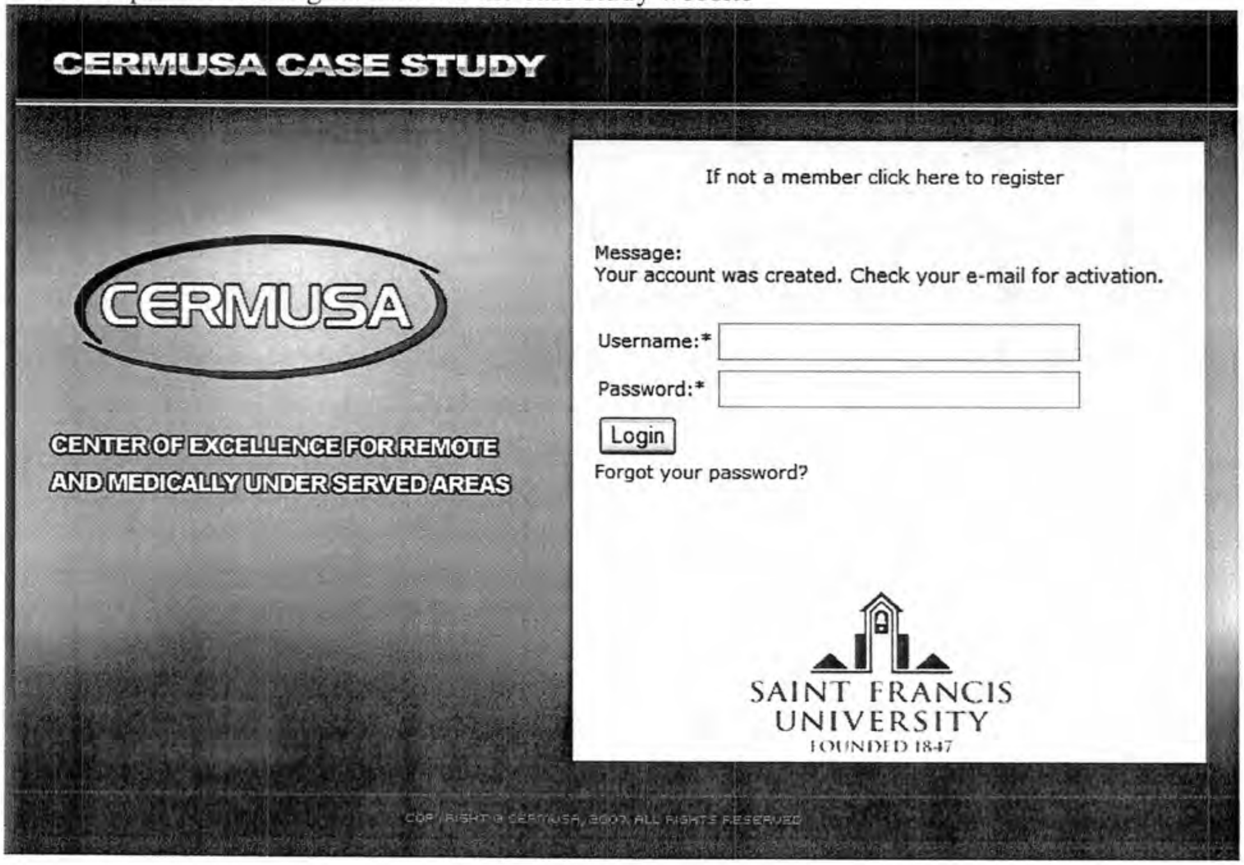
The first version of the case study can be seen below in Figure 1 (Online link to first version: http://courses.cermusa.francis.edu/ortho/index.html). The photograph is a screen capture of the student view. The case study was developed into four major components. The first is an instruction and patient record, next are questions that can be asked of the patient, third is examine the patient procedures that can be performed, and finally a diagnosis can be performed. The case studies also developed a library of supplemental materials. The amputation subjects that the case studies discuss all have possible complications or require complex treatments. It was clear when working with the medical authors and subject matter experts that there was a need for a library of additional information. This information can greatly assist students to see the interconnections of chronic diseases such as diabetes, renal failure, and amputations.

Figure 1
Screen capture of the student view of a case in the old case study website



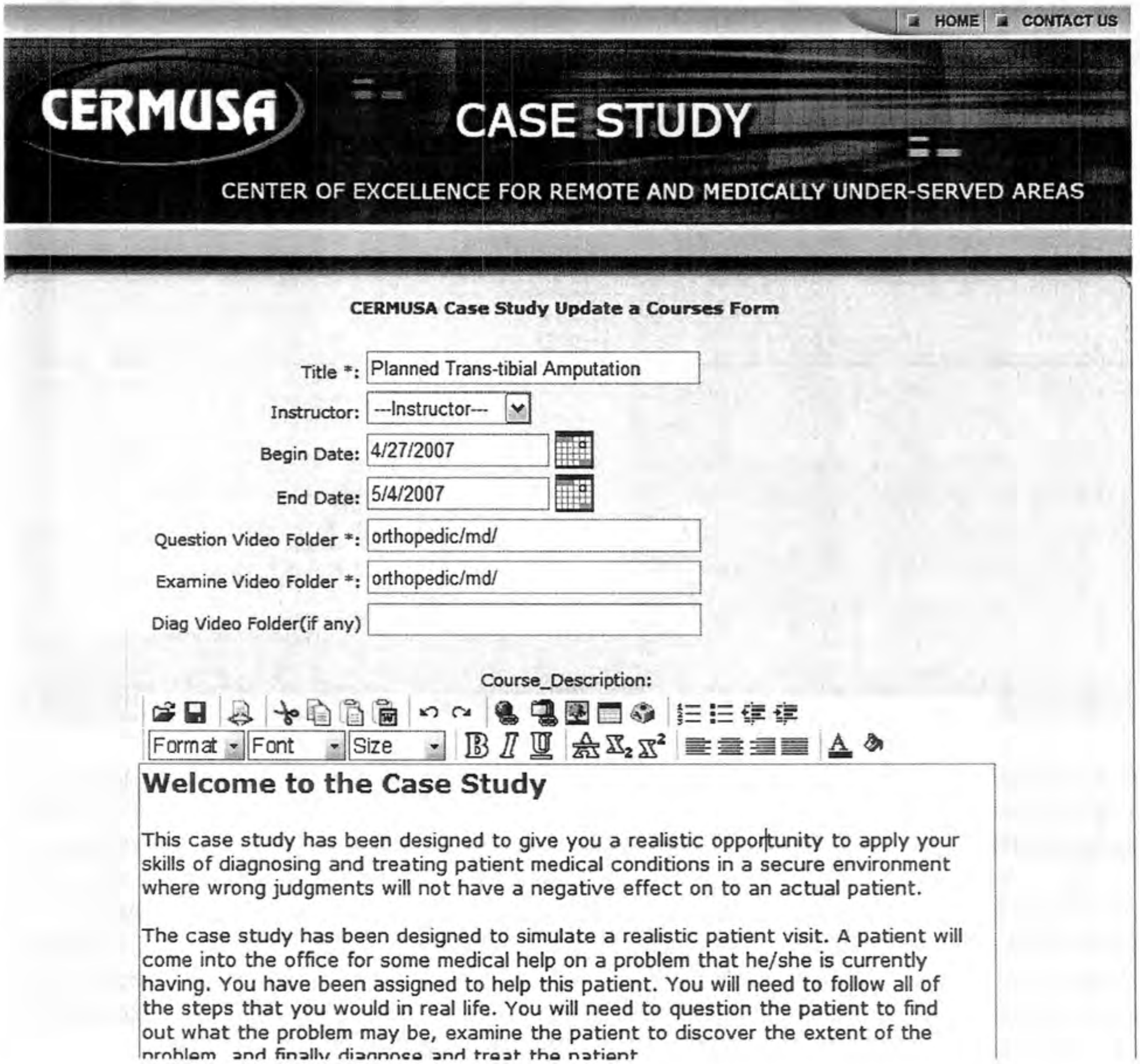
While the case study software was developing into an invasive multimedia approach to the case study method of learning, it was complex in its design. The case studies were flat html pages that were only hyperlinked to one another. As the quality and number of content pages grew it was clear that a better approach was needed. The first issue was to develop the ability to track students. As shown in Figure 2, a login screen was needed so that students could access a secure system and complete a diagnosis. This login feature also permitted instructors to be able to grade and respond to questions, all within the application.

Figure 2
Screen capture of the login screen to the case study website



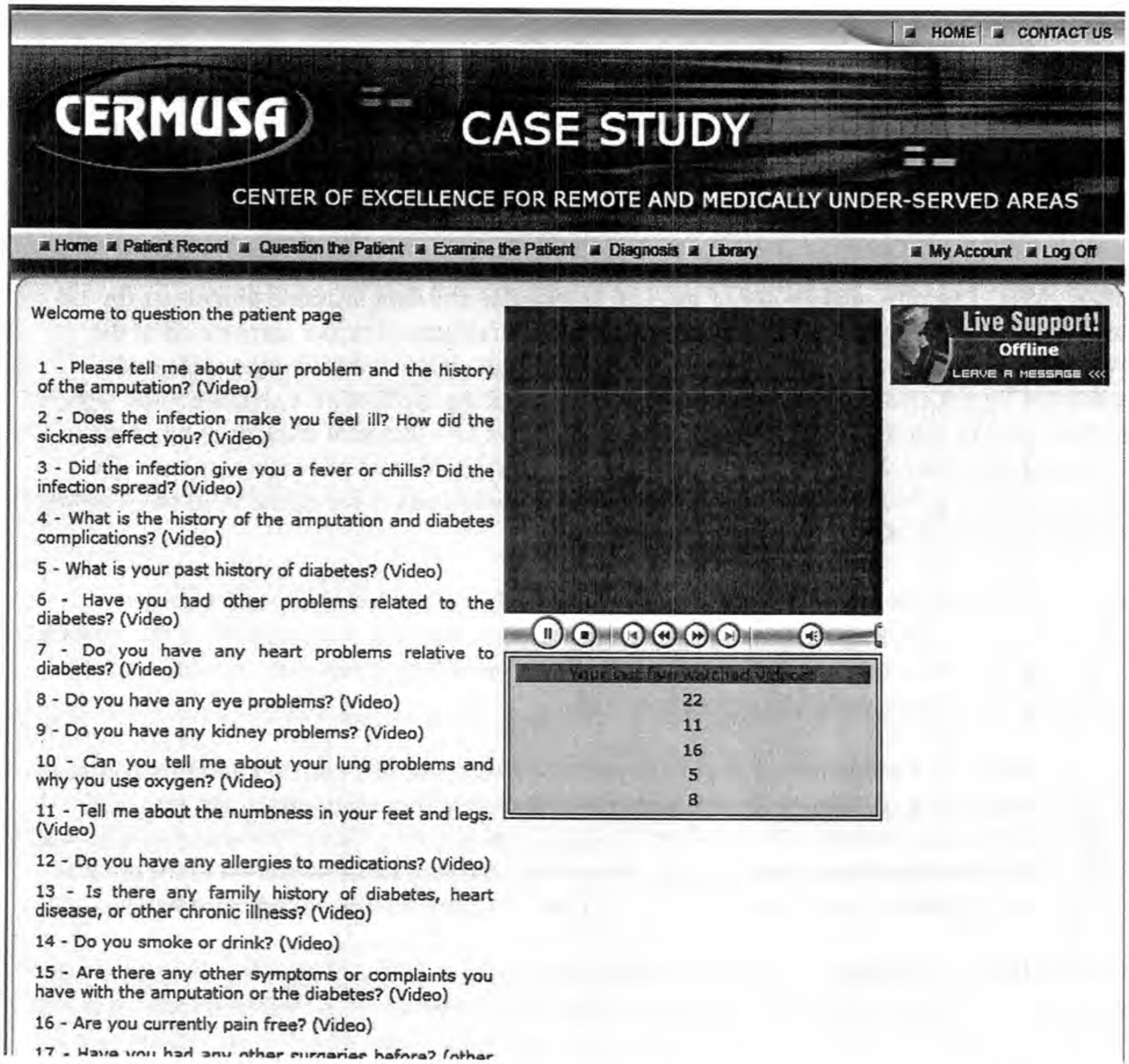
Another major improvement to the case study software was the designer functions as seen in Figure 3. The previous version required a programmer to individually create and link all the web pages together. In the new version, the medical instructor can create the case study themselves. To create a new case study page or add an item to the library of supplemental materials, the instructor simply logs in and fills in a form and clicks submit. A page with all the content is automatically created and this page can easily be edited by clicking on the edit function. All the content and displays are customizable. Any form of multimedia can be added by uploading it into the software and if the same piece of multimedia needs to be shown in multiple places there is no need to upload it multiple times. The instructor just links to it as needed.

Figure 3
Screen capture of a designer view of a case study in the system



The student view has also been dramatically improved as seen in Figure 4. All of the links to the various sections of the case study have been placed along a latitude of menu options. New functions like live support, a logging history of videos watched, and the ability to double check diagnosis answers before submission, have been added. The new design is simpler and easier to navigate.

Figure 4
Screen capture of a student view of a case study in the system



The study has developed a comprehensive case study software that can be implemented for effective and interactive instruction not just in medical education but additional fields in the social sciences as well. The amputation case studies of a planned diabetic trans-tibial below-knee amputation and traumatic war-time trans-tibial amputation served as the final exam for the Spring 2007 special topics physical therapy class. The students studied each of the case studies and provided a diagnosis for each one. Additionally, the students compared and contrasted the patients through the results of examination procedures and questioning the patient techniques in the multimedia case study. The course instructor noted the dramatic increase of participation of the students in follow-up discussions and the in-depth process analysis and thinking patterns that were evident by using the multimedia case studies. The software will be implemented and researched with students and instructors in FY07 studies.

The effective use of handheld devices was researched with the subjects in the study. The devices in the study included the Apple iTouch, Apple iPod, Archos 604WiFi, Creative Zen M, Palm T/X, and a portable DVD player. The handheld devices were loaded with multimedia content pertaining to diabetes, amputation, and patient management techniques for physical therapists. A technical summary of each of these devices can be found in the results of the next research question.

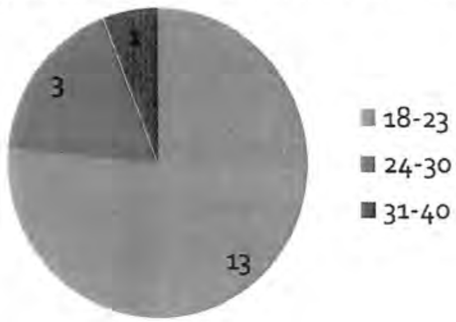
The content loaded into each device was the same for every handheld. The content included audio, video, diagrams, and photos of medical knowledge and demonstrable treatments for amputation care. The production of the multimedia content was intensive since much of the content contains important procedures on how to perform several rehabilitation skills and treatments for patients. Subject matter experts and practicing medical providers were the featured therapists in the videos. The other visuals and audio were also acquired from existing libraries of material from earlier studies and/or created with the assembled team of content authors. The content has strong potential for being useful in future studies and is beneficial to future semesters of special topics courses in physical therapy.

The handheld devices can be used in conjunction with the online case study software or independently, depending on the instructor's curriculum needs. The handhelds have the ability to build upon the case studies or classroom instruction by providing a personal interaction of the content for students to study and experiment with.

The handhelds were implemented in the Summer 2007 semester of a patient education course in the physical therapy program with 17 students to collect affective assessments and instructor feedback. The students learned how to operate each of the devices. Their final group project was to take each device and report how it could be used to conduct patient education in the clinical setting. The interactions and reaction of the students using the devices are reported below.

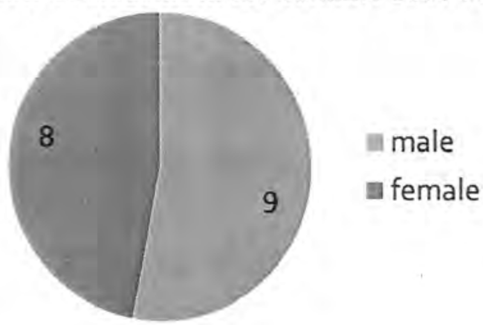
The first data to be collected was demographic information with the 17 students that participated in the study. The age of the students in the Summer 2007 semester of A Patient Education course is reported in Figure 5. In the 18-23 years of age range there were 13 (76%) individuals, in the 24-30 age range there were 3 (18%) individuals and in the 31-40 age range there was 1 (.06%) individual. The majority of the participants in the handheld study (76%) were 18-23 years of age.

Figure 5
Age of students in the Summer 2007 semester of a patient education course.



The gender of the students in the Summer 2007 semester of a patient education course is reported in Figure 6. Of the 17 students, there were 8 (47%) female and 9 (53%) male. The class was gender neutral; no gender was more significant in number.

Figure 6
Gender of students in the Summer 2007 semester of a patient education course



The race of the students in the Summer 2007 semester of a patient education course is reported in Figure 7. The students reported as all 17 (100%) being white.

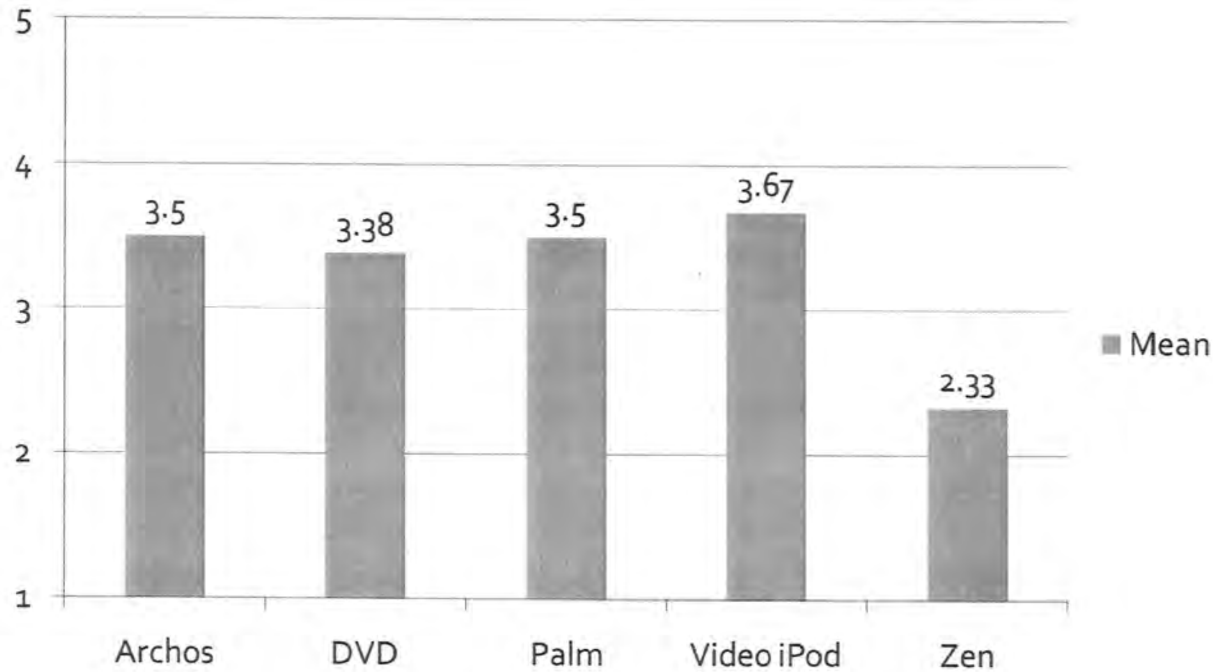
Figure 7
Race of students in the Summer 2007 semester of a patient education course

In Figure 8, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how the activity met the learning objectives. The mean score for each handheld device is reported. The Archos rated at 3.5, the DVD at 3.38, the Palm at 3.5, the Video iPod at 3.67, and the Zen at 2.33.

The video iPod was rated slightly higher at 3.67 over the Archos, DVD, and Palm. The Zen was rated a full rating on the Likert scale below all the other devices at 2.33. The survey participants reported that the Zen did a fair job when it came to rating the effectiveness of how the activity met the learning objectives but all the other devices were good if not better than the Zen.

Figure 8

Rate the effectiveness of how the activity met the learning objectives.

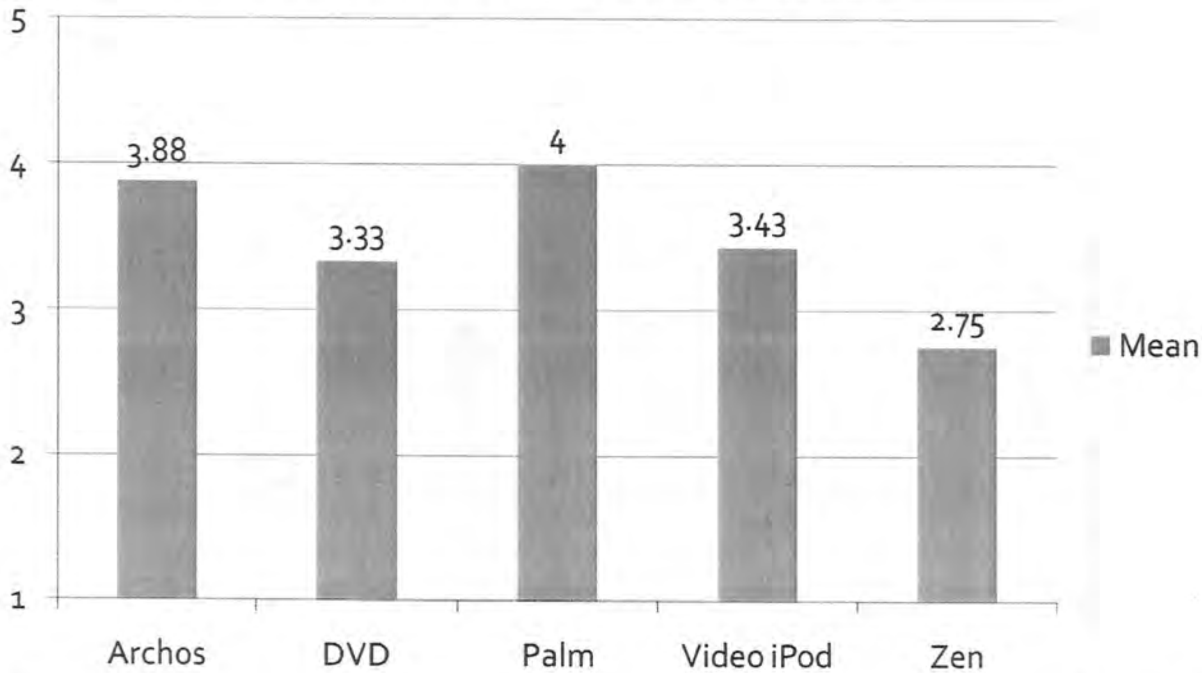


In Figure 9, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how the activity related to their practice needs. The mean score for each handheld device is reported. The Archos rated at 3.88, the DVD at 3.38, the Palm at 4.0, the Video iPod at 3.43, and the Zen at 2.75.

The Palm was rated slightly higher at 4.0 with the Archos at a close 3.88. The Zen again, was rated below all the others at 2.75. The survey participants reported that the Zen did a fair to good job when it came to rating the effectiveness of how the activity related to your practice needs, but all the other devices were good to very good. The Palm and Archos were rated the highest in relation to the practice needs of physical therapists.

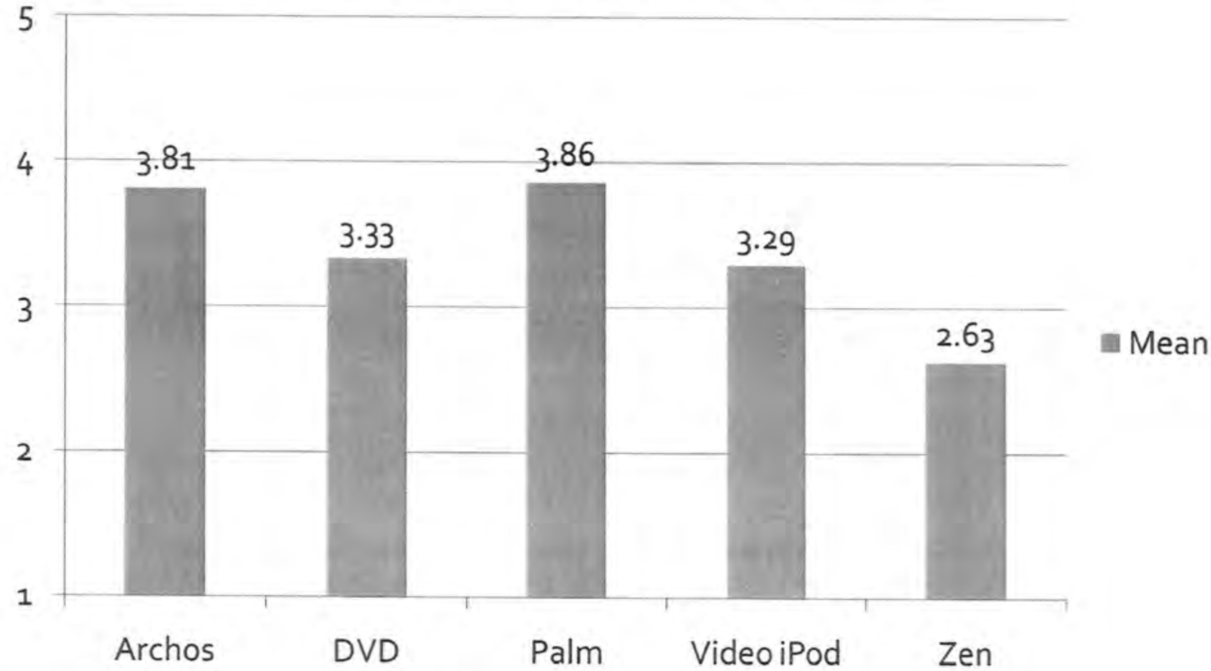
Figure 9

Rate the effectiveness of how the activity related to your practice needs.



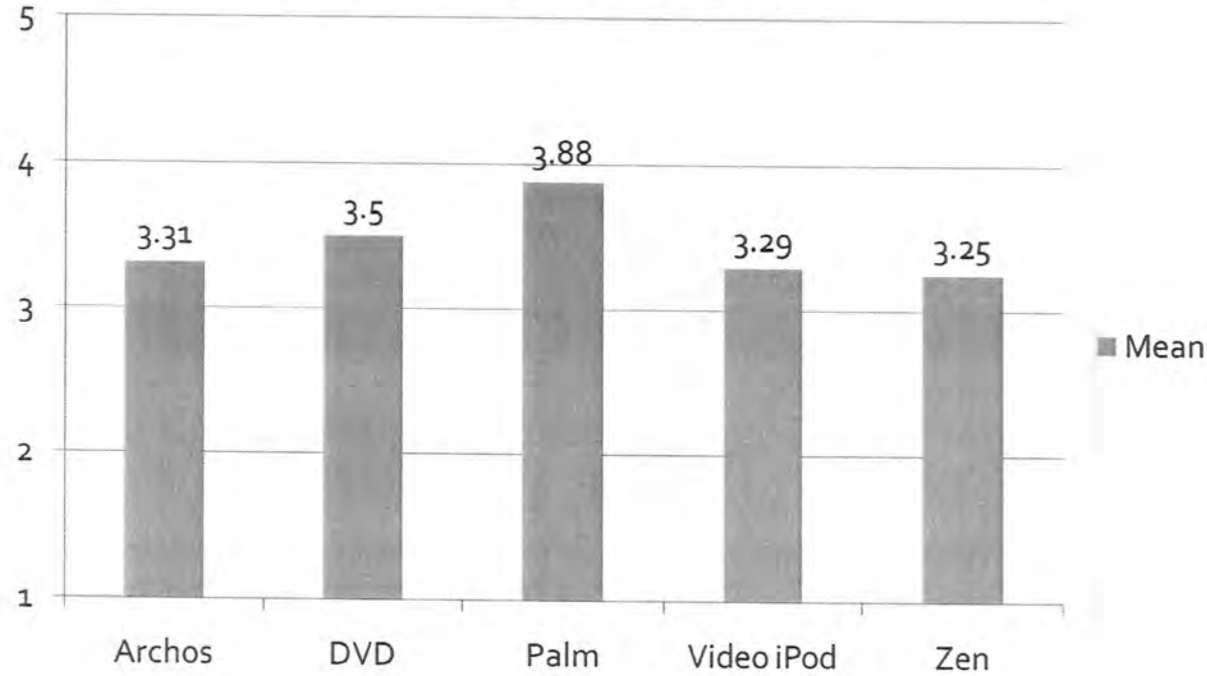
In Figure 10, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how the activity will help them improve patient care. The mean score for each handheld device is reported. The Archos rated at 3.81, the DVD at 3.33, the Palm at 3.86, the Video iPod at 3.29, and the Zen at 2.63.
The Palm was rated slightly higher at 3.86 with the Archos at a close 3.81. The Zen again, was rated below all the others at 2.63. The survey participants reported that the Zen did a fair to good job when it came to rating the effectiveness of how the activity will help you improve patient care but all the other devices were above good to very good. The Palm and Archos were rated the highest for using the device to improve patient care.

Figure 10
Rate the effectiveness of how the activity will help you improve patient care.



In Figure 11, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how the activity will help them improve patient care. The mean score for each handheld device is reported. The Archos rated at 3.31, the DVD at 3.5, the Palm at 3.88, the Video iPod at 3.29, and the Zen at 3.25.
The Palm was rated higher at 3.88 as very good with the DVD trailing behind with a 3.5. The remaining devices were all rated close together, at 'good' from 3.25 to 3.31. All the devices were at least rated good when it came to rating the effectiveness of how the author conveyed the subject matter. The Palm and DVD were rated the highest by the survey respondents.

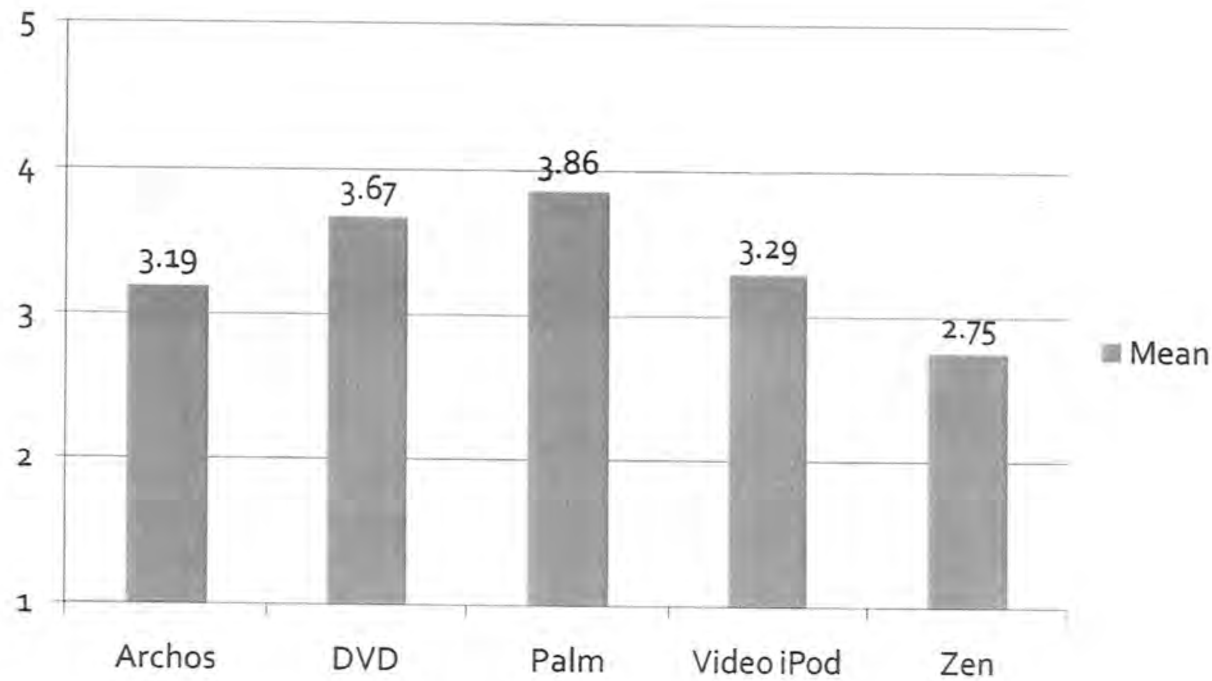
Figure 11
Rate the effectiveness of how the author conveyed the subject matter.



In Figure 12, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the overall quality of the activity. The mean score for each handheld device is reported. The Archos rated at 3.19, the DVD at 3.67, the Palm at 3.86, the Video iPod at 3.29, and the Zen at 2.75.

The Palm was rated the highest at 3.86 with the Archos, DVD, and Palm all within less than one rating on the Likert scale below the Palm. The Zen was rated a full rating below all the other devices at 2.75. The survey participants reported that the Zen did a fair job when it came to rating the overall quality of the activity, but all the other devices were good, if not better, than the Zen.

Figure 12
Rate the overall quality of the activity.



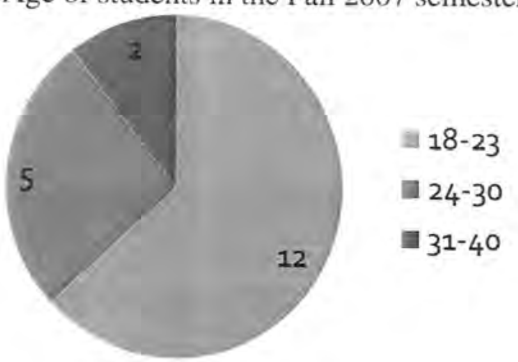
The survey respondents were asked additional open-ended questions concerning the use of the handheld devices. When asked what motivational factors help you to complete distance education activities, they reported that, they enjoy learning and participating in in-class activities. When asked, when is the best time of day and time of year for continuing education, all the survey participants answered summer due to a lighter work load and more free time to participate.

In summary, the Summer 2007 semester of a patient education course in the physical therapy program with 17 students rated the Palm as the most effective device with the Archos device close behind. The Zen rated the lowest in effectiveness and the remaining devices were neutrally rated as good by the survey participants.

The final data collection was with affective assessments that were conducted in the Fall 2007 semester of the Patient/Client Management course in the Physical Therapy department at Saint Francis University with 19 students. The activity that was evaluated was the video skills assessments. The video skills assessments occur at intervals in the course during the lab sessions. The purpose of the skills assessments is to evaluate students on demonstrable skills in physical therapy. The two lab sessions that were conducted using the video equipment were the pediatric gait assessment and interventions and proprioceptive neuromuscular facilitation. The procedure for the skill assessments was that the instructor would cover the material in class and demonstrate the physical examination procedures. Then during the students' laboratory exam they would conduct several examination procedures. The group activity consisted of several roles; a group of 4 would have each student assuming the role of parent, child, physical therapist, and critical peer/camera operator. Each student had 30 minutes in a role then switched until everyone has assumed the role of the physical therapist. An entire group would take approximately two hours to complete the cycle. Following this procedure, the students would place their videos into their laptops and conduct self-assessments and group assessments. After the lab session, the instructor would conduct an assessment from their perspective for each student. The following class session, the multiple evaluation perspectives would be shared with the students and the videos reviewed in class to answer any questions or provide additional instruction.

The first data to be collected was demographic information with the 19 students that participated in the study. The age of the students in the Fall 2007 semester of a Patient/Client Management course is reported in Figure 13. In the 18-23 years of age range there were 12 (63%) individuals, in the 24-30 age range there were 5 (26%) individuals and in the 31-40 age range there were 2 (11%) individuals. The majority of the participants in the video skills assessment study (63%) were 18-23 years of age.

Figure 13
Age of students in the Fall 2007 semester of a Patient/Client Management course.



The gender of the students in the Fall 2007 semester of a Patient/Client Management course is reported in Figure 14. Of the 19 students there were 12 (63%) female and 7 (37%) male. The class contained 5 more females than males.

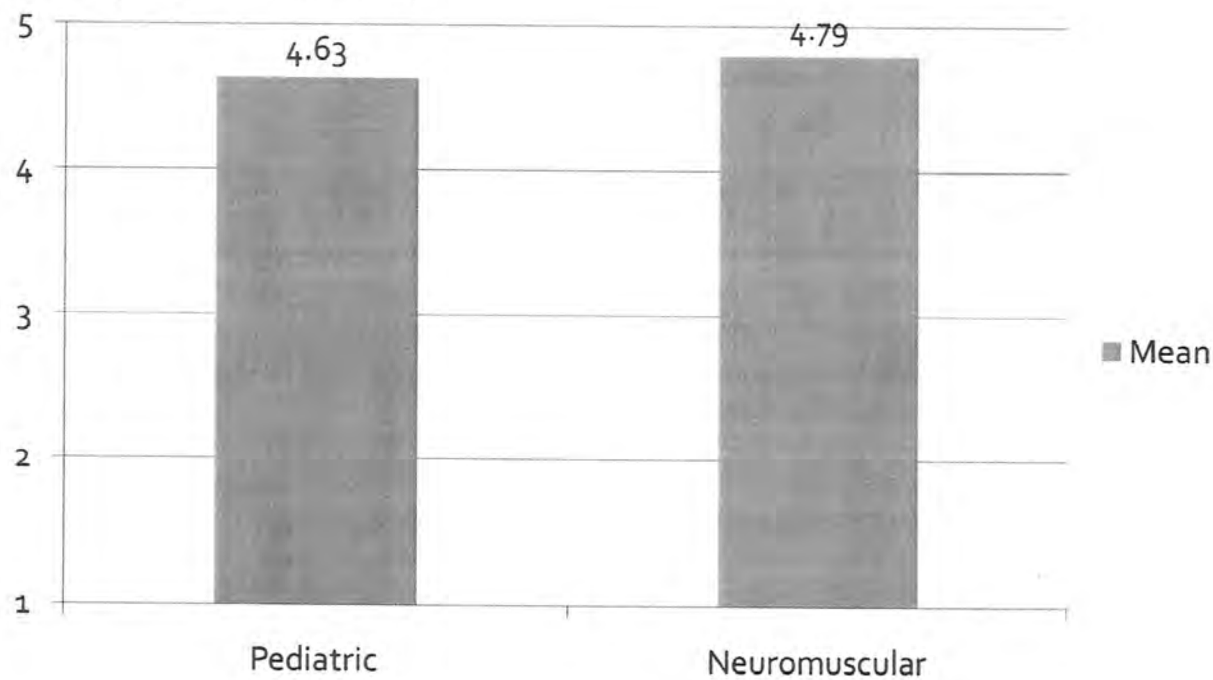
Figure 14
Gender of students in the Fall 2007 semester of a Patient/Client Management course.

The race of the students in the Fall 2007 semester of a Patient/Client Management course is reported in Figure 15. The students reported as 18 (95%) as white and 1 (5%) as other.

Figure 15
Race of students in the Fall 2007 semester of a Patient/Client Management course

In Figure 16, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the quality of the technology. The mean score for each of the lab exams is reported. The pediatric exam rated at 4.63 and the neuromuscular exam rated at 4.79.
The technology used in the video skills assessment was rated very good to excellent for both lab exams by the survey participants. The students felt the quality of the technology they were using was very high.

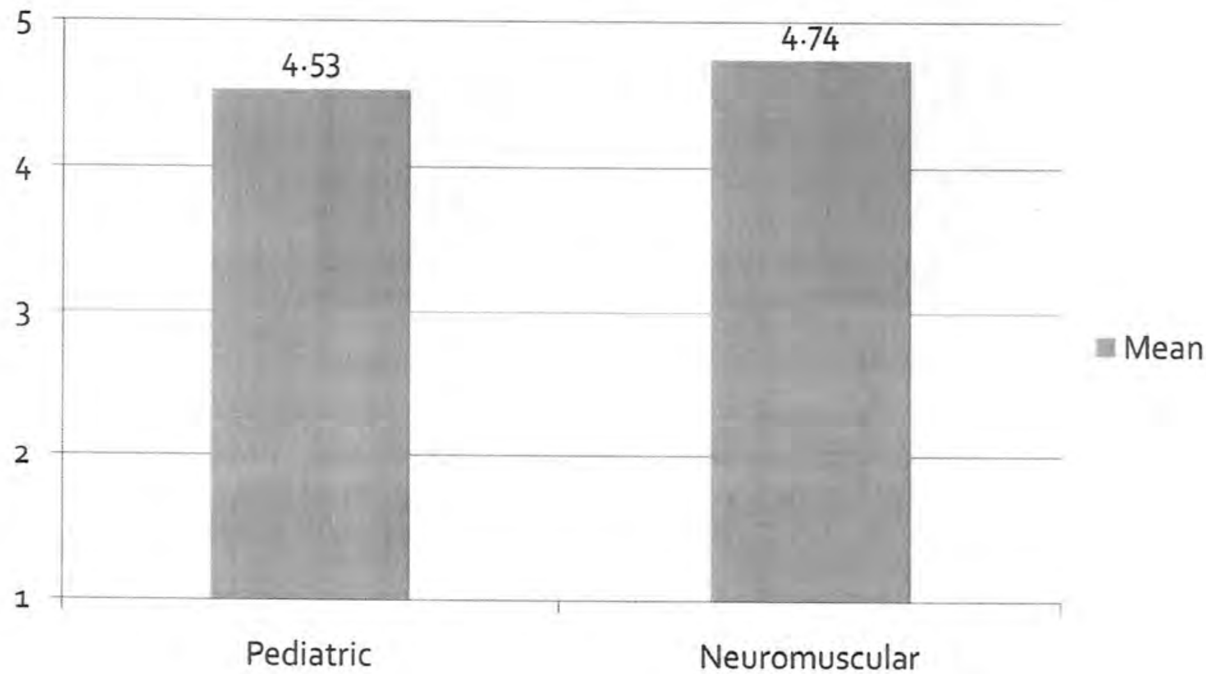
Figure 16
Rate the quality of the technology.



In Figure 17, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how well the technology related to your practice needs. The mean score for each of the lab exams is reported. The pediatric exam rated at 4.53 and the neuromuscular exam rated at 4.74.

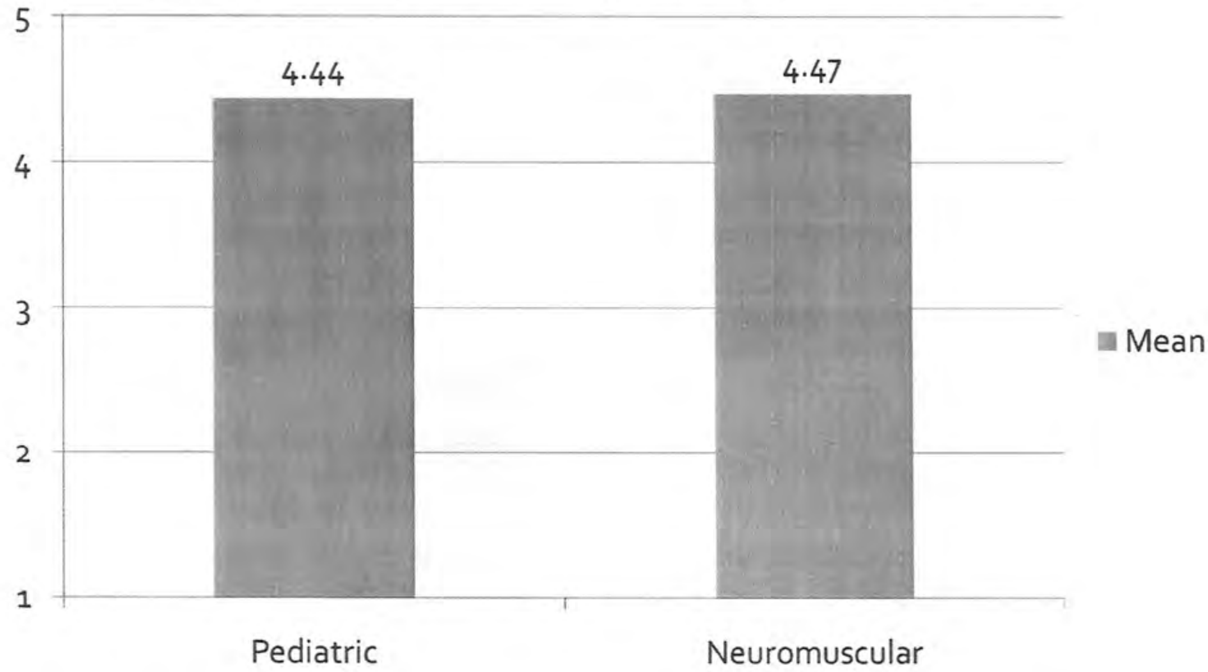
The relation of the technology to their practice needs in the video skills assessment was rated very good to excellent for both lab exams by the survey participants.

Figure 17
Rate the effectiveness of how well the technology related to your practice needs.



In Figure 18, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the effectiveness of how well the technology could help you improve patient care. The mean score for each of the lab exams is reported. The pediatric exam rated at 4.44 and the neuromuscular exam rated at 4.47.
The technology used in the video skills assessment was rated very good to excellent for both lab exams by the survey participants. The students felt the technology could help them improve their level of patient care.

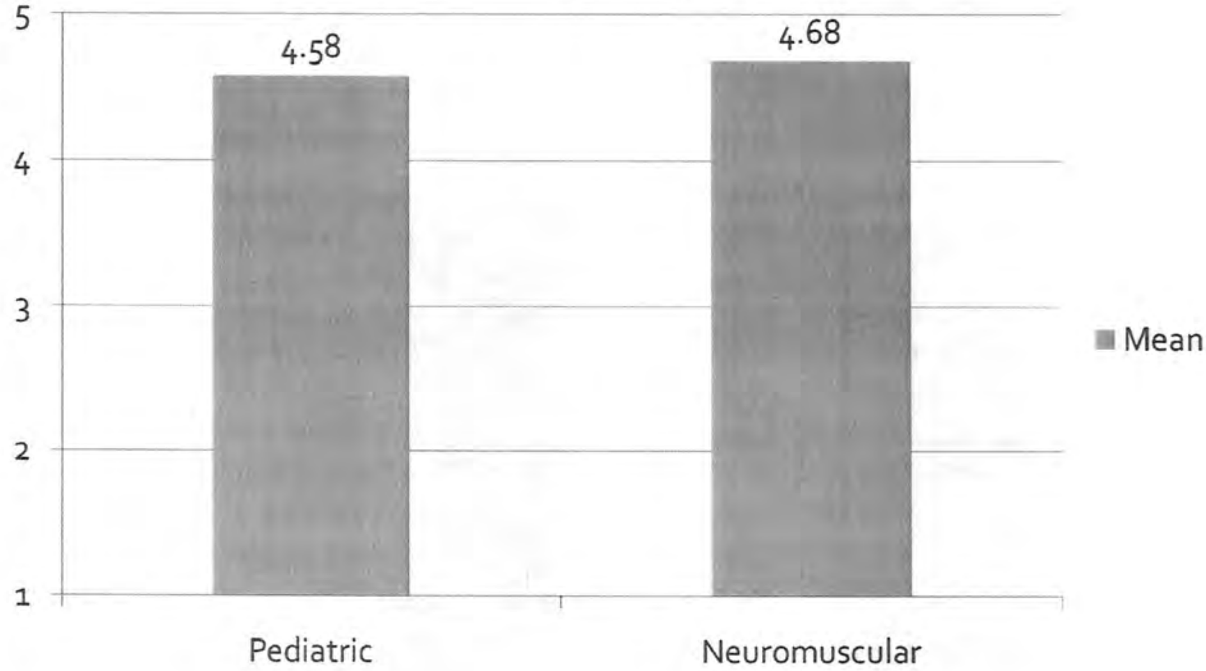
Figure 18
Rate the effectiveness of how well the technology could help you improve patient care.



In Figure 19, the survey participants rated on a scale from 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent) the overall quality of using the technology in the group activity. The mean score for each of the lab exams is reported. The pediatric exam rated at 4.58 and the neuromuscular exam rated at 4.68.

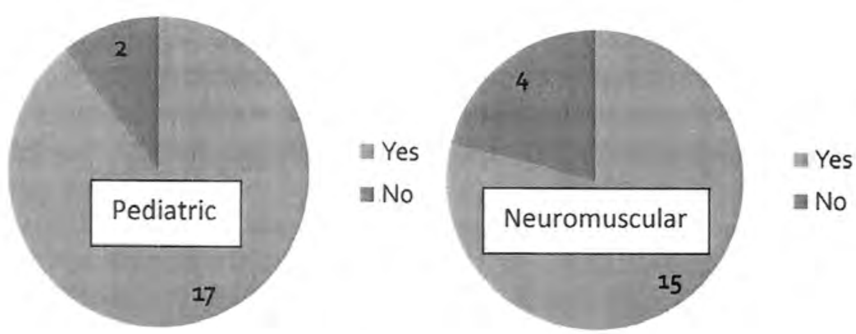
The technology used in the video skills assessment was rated very good to excellent for both lab exams by the survey participants. The students felt the overall group activity and the technology used were very effective in the lab exam sessions.

Figure 19
Rate the overall quality of using the technology in the group activity.



In Figure 20, the survey participants answered yes or no if they could see themselves using the technology in a clinical environment. The pediatric exam reported 17 (89%) yes and 2 (11%) no and the neuromuscular exam reported 15 (79%) yes and 4 (21%) no. The majority of students for both lab exams could see themselves using the technology in a clinical environment.

Figure 20
Could you see yourself using this technology in a clinical environment?

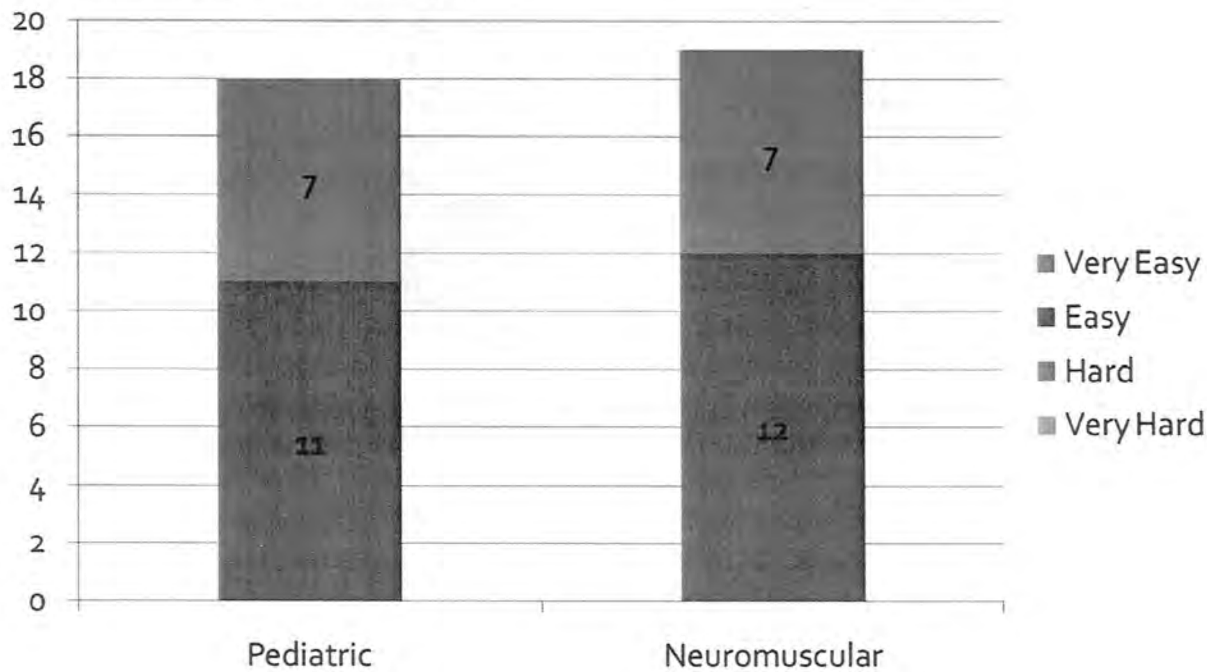


In figure 21, the survey participants' responded very easy, easy, hard, and very hard to rate the ease of using the technology. The results for each of the lab exams are reported in Figure 21. The pediatric exam rated at 7 very easy and 11 easy and the neuromuscular exam rated at 7 very easy and 12 easy.

The ease of using the technology used in the video skills assessment was rated very easy to easy for both lab exams by the survey participants. The students felt the technology was uncomplicated and simple to use.

Figure 21

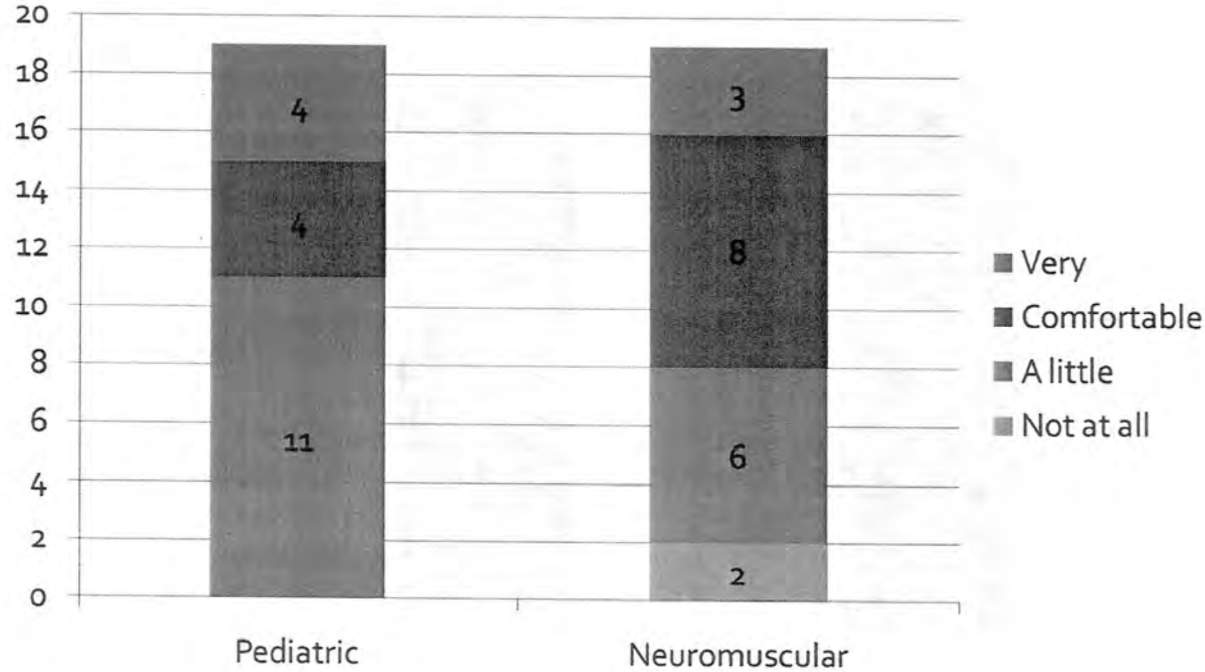
Rate the ease of using the technology.



In Figure 22, the survey participants responded very comfortable, comfortable, a little comfortable, and not at all comfortable to rate their previous comfort level of using the technology. The results for each of the lab exams are reported in Figure 22. The pediatric exam rated 4 at very comfortable, 4 at comfortable and 11at a little comfortable. The neuromuscular exam rated 3 at very comfortable, 8 at comfortable, 6 at a little comfortable, and 2 not at all comfortable.

The majority of the comfort levels for both lab exams was reported as a little comfortable or comfortable by the survey participants. Prior to using the technology the students were comfortable but not very, the results after using the technology are reported in Figure 23.

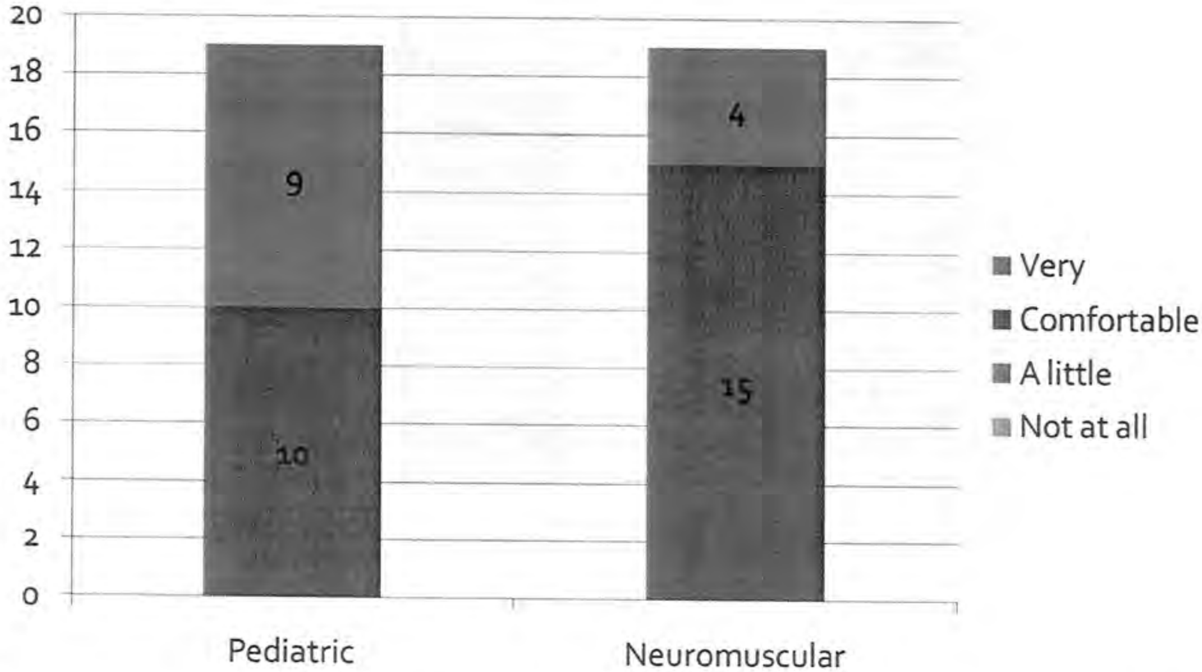
Figure 22
Rate your previous comfort level of using the technology.



In Figure 23, the survey participants responded very comfortable, comfortable, a little comfortable, and not at all comfortable to rate their comfort level of using the technology after using it. The results for each of the lab exams are reported in Figure 23. The pediatric exam rated at 9 very comfortable and 10 comfortable. The neuromuscular exam rated at 4 very comfortable and 15 comfortable.

The majority of the comfort levels for both lab exams was reported as very comfortable or comfortable by the survey participants. The students felt more comfortable with the technology after using it.

Figure 23
Rate your comfort level of using the technology after using it.



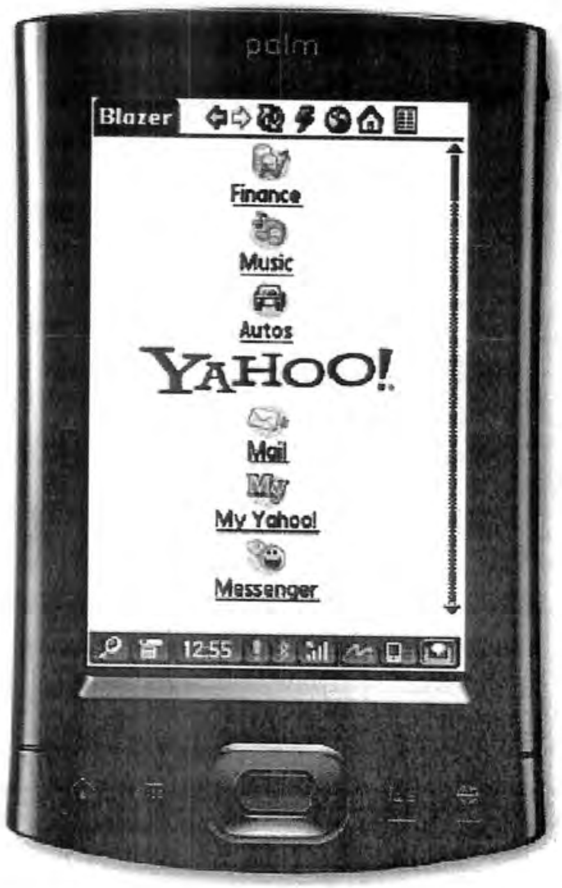
Finally, the survey participants could provide any comments or suggestions to an open-ended question. The respondents reported that the video technology definitely improved the clinical experience and that the only drawback is that finalizing the disk takes some time. However, the video assessments save a lot of classroom time. The clinical evaluations used to take 8 hours now they take only 4 hours. Finally, the students reported that they liked being able to evaluate themselves later, they never had this opportunity before. Now they have a benchmark, to compare themselves to later to see how they improve.

The third research question asked to research future technologies that have the potential for delivering education to rural medical professionals. The first step to selecting which technologies to acquire in the study involved assembling a focus group. The focus group was comprised of technical and instructional subject matter experts that included an instructional designer, video production specialist, computer technology specialist, medical physician, physical therapist, and a medical student. Each conducted research and experimented with available technologies in the marketplace to recommend handhelds and video technology to include in the study. Their recommendations of the emerging technologies to be used in the study were acquired and tested with the study subjects. A description of each device is found below and a video describing each device is available for viewing.

The first handheld device is the Palm T/X in Figure 24. It has built-in Wi-Fi and Bluetooth technology; it can browse the web and check email. The Palm can display Word, Excel, and PowerPoint files and play photo slideshows, videos, and MP3s. It has a 320 x 480 transflective

TFT touch screen display, landscape and portrait orientation modes, and an external speaker and headphone jack.

Figure 24
Palm T/X Handheld

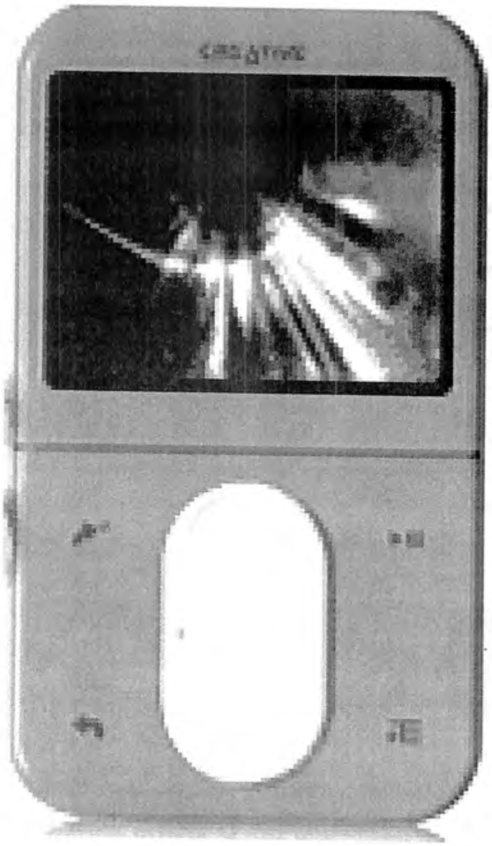


The next handheld device is the video iPod with the MyVu Personal Media Viewer in Figure 25. The video iPod has a 2.5" full-color screen with click wheel navigation. It can hold up to 20,000 songs, 25,000 photos, and up to 100 hours of video. There are many free podcasts available for the device including educational tours of museums and audio books. There are also many accessories available including the MyVu Personal Media Viewer glasses that enable portable 3D viewing.

Figure 25
Video iPod with the MyVu Personal Media Viewer

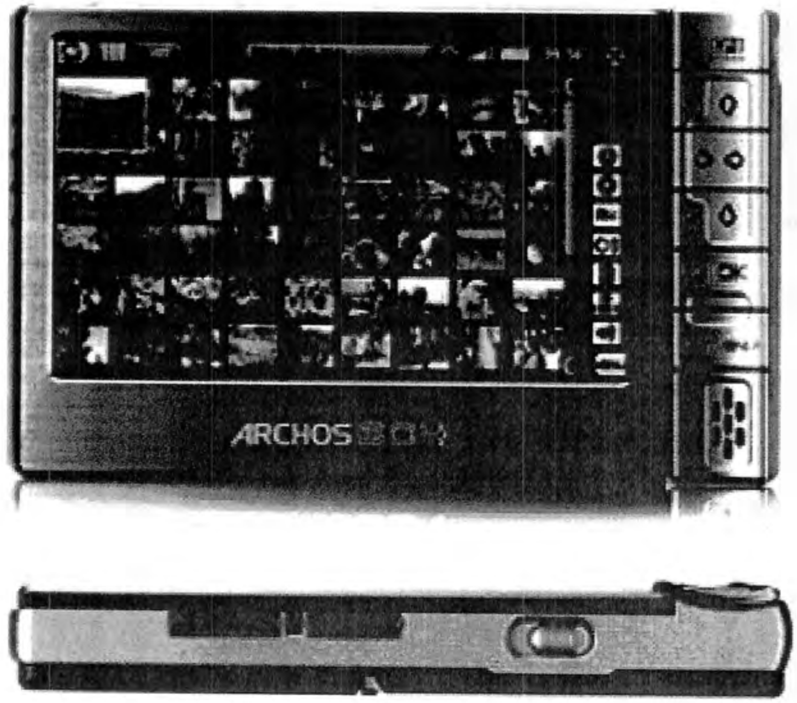
The next handheld device is the Creative Zen Vision M in Figure 26. The Zen has a 2.5" full-color screen and a USB host feature. It can hold up to 250 hours of movies, tens of thousands of photos, and 15,000 songs. A video out connection can be used with a projector or television for remote viewing. It also has a vertical touch pad, rechargeable Li-ion battery, FM radio, personal organizer, voice recorder, and access to podcasts.

Figure 26
Creative Zen Vision M



The next handheld device is the Archos 604WiFi in Figure 27. The Archos has a 4.3" full-color touch screen, wireless Internet and video streaming from PC to TV capabilities. It can hold up to 300,000 pictures, 15,000 songs, and 40 movies. It plays standard video formats in full DVD resolution and can be used with a DVR station to record television and movies. The Archos has exterior speakers, a removable battery, and a kickstand for tabletop viewing.

Figure 27
Archos 604WiFi



The final handheld device is the portable DVD player in Figure 28. It plays DVD media with a large display screen. The portable DVD player has onboard controls, a remote control and external speakers with a headphone jack.

Figure 28
Portable DVD player

The video technology researched in the technology consisted of two components; the first was the SunPak 7001 DX digital tripod as seen in Figure 29. The tripod has a fluid effect with a 3-way pan head, extends to 58.3", weighs 2.9 lbs, and supports 4.4 lbs. The tripod comes with extra shoes and traveling case. The 7001DX is equipped with locking leg braces, center column tension/load adjustment, quick-release leg locks and retractable leg spikes for fast setup and solid stability. The geared center column with elevation locking knob allows fast height adjustments, and a secondary ¼-20" mounting stud is included at the bottom of the center column.

Figure 29
SunPak 7001 DX Digital Tripod

The final piece of video technology researched in the study was the Panasonic VDR-D230 DVD video camera as seen in Figure 30. The Panasonic VDR-D230 records directly onto DVD-RAM, DVD-RW, DVD-R or –R Dual Layer discs. The 2.7" wide LCD screen delivers a clear picture of the action during recording and playback. The High Quality 16:9 option permits the operator to record in wide-screen mode. It has a 32x optical zoom that produces close-up shots with clarity. The Optical Image Stabilizer (OIS) feature cancels the hand shake effect by stabilizing the image before it reaches the CCD. This is a very effective feature when using 32X zoom because it allows for zoom in/out without blur and shaking. The one-touch navigation joystick allows the operator to have simple control for all menu items and is centrally located for easy use. The video camera can also shoot digital still photographs on SD memory cards. The camera also has a USB 2.0 interface. This feature can transfer still pictures and video to a computer at high speed over a USB cable.

Figure 30
Panasonic VDR-D230 DVD Video Camera

The implications of using technology in the classroom is having the potential to increase the interaction and learning gains of students. Health education at a distance has to connect learners and deliver course content (Gay & Airasian, 2002). The over-arching objective of this study was to effectively communicate the pedagogic ideas of a demonstrable skill by effectively using distance learning technologies to support the content (Norris, 1998). The final outcomes from this part of the study is the recommendation that when implementing technology in the medical curriculum is that the students should understand the materials, the knowledge gains should be obtainable, the technology should permit the opportunity for authentic assessments (group activities, demonstrable skills, etc.), and the assessment strategies for provider-patient exams should be as interactive and hands-on as the actual act of performing the exam itself. Not a text-based exam but an interactive gaming opportunity thru a role-playing case study, interactive handheld video, or a visual recording of a practice patient-provider interaction that permits several perspectives of assessment.

Key Research Accomplishments:

The study has had importance for Saint Francis University's CERMUSA, the military, and the public. CERMUSA benefits from the study by now owning several innovative pieces of technology that can also be used in future studies and projects. The technology includes the handhelds, video equipment, audio equipment, and case study software. This study has also conducted research of emerging methodologies and applications that can be applied into future studies. The outcomes of the study provide data and information for educational policy and application changes within the academic community and also provide literature content for future publications and presentations. The military benefits from topics in amputation and complications that are specific to traumatic injuries were developed into educational modules.

These topics that benefit soldiers and veterans were also placed within a special topics physical therapy course that previously did not cover this topic. The public benefits from having an educated medical workforce about the uniqueness of traumatic and diabetic amputations, pediatric gait assessment and proprioceptive neuromuscular facilitation. This is beneficial to the diagnosis and treatment of each for patients.

Reportable Outcomes:

The reportable outcomes that have resulted from this research are listed below.

Presentations

- 2007 Showcase for Commerce in Johnstown, Pennsylvania
- 2007 Armstrong Technology Exposition in Armstrong, Pennsylvania
- 2007 EDUCAUSE conference in Seattle, Washington

Accepted for Presentation

- 2007 Adult Education and Communications Technology conference in San Francisco, California
- 2007 Education and Information Systems, Technologies and Applications conference in Orlando, Florida
- 2008 American Telemedicine Association conference in Seattle, Washington

Conclusions:

This study researched whether the case study method of learning and the interactive method of learning are both effective interactive methods of learning and assessment in the medical education classroom. The technological appropriateness of handhelds and video technology in the medical training classroom was researched to be effective and the study of this technology will continue in the FY 07 study. The extensive content developed to educate students on the treatments and diagnosis of traumatic amputations evolved the curriculum of physical therapists and gained the attention of other medical departments at Saint Francis University. The authentic assessment taskforce committee at the university reviewed the technical interventions in the classroom and would like to implement handhelds and video assessments in additional medical majors of study. The study has also worked with veterans' hospitals and organizations to develop and test the content, including the National Naval Medical Center in Bethesda, Maryland. In the future, the study will seek to partner with agencies such as the National Amputee Coalition to accomplish the project's goal of better care for war veterans.

References:

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Appendices:

The appendixes attached are the affective assessments developed for the study. The multimedia elements (video, sounds, diagrams, photos, dynamic text) are available online at http://casestudy.cermusa.francis.edu and on the handheld devices.

Appendix A - Affective assessment for the video technology
Appendix B - Affective assessment for the handheld technology

Appendix A

Survey

Please complete the survey below by selecting a response to each question. You may refuse to answer any item without repercussion. By completing this questionnaire, I indicate my consent to participate in the study. I understand confidentiality will be maintained.

Protocol Title	Specialized Medical Training for Rural Medicine
Protocol Number	05-TATDL203-05

Video Equipment Affective Assessment

	Excellent	**Very Good**	**Good**	**Fair**	**Poor**
Rate the quality of the technology (camera and equipment):	5	4	3	2	1
Rate the effectiveness of how well the technology (camera and equipment) related to your practice needs:	5	4	3	2	1
Rate the effectiveness of how well the technology (camera and equipment) could help you improve patient care:	5	4	3	2	1
Rate the overall quality of using the technology (camera and equipment) in the group activity:	5	4	3	2	1

Could you see yourself using this technology (camera and equipment) in a clinical environment?	YES		NO	
Rate the ease of using the technology (camera and equipment):	Very Easy	Easy	Hard	Very Hard
Rate your previous comfort level of using the technology (camera and equipment):	Very comfortable	Comfortable	A little comfortable	Not comfortable at all
Rate your comfort level of using the technology (camera and equipment) after using it:	Very comfortable	Comfortable	A little comfortable	Not comfortable at all
Suggestions/Comments:				

Demographics

Age	**Gender**	**Race**	**Zip code:**
A. 17 and younger B. 18-23 C. 24-30 D. 31-40 E. 41 and older	A. Male B. Female	A. White (not of Hispanic origin) B. Black C. Hispanic D. Asian E. Other	____________

Appendix B

Survey

Please complete the survey below by selecting a response to each question. You may refuse to answer any item without repercussion. By completing this questionnaire, I indicate my consent to participate in the study. I understand confidentiality will be maintained.

Protocol Title	Specialized Medical Training for Rural Medicine
Protocol Number	05-TATDL203-05

	Excellent	**Very Good**	**Good**	**Fair**	**Poor**
Rate the effectiveness of how the activity met the stated learning objectives:					
Rate the effectiveness of how the activity related to your practice needs:					
Rate the effectiveness of how the activity will help you improve patient care:					
Rate the effectiveness of how the author conveyed the subject matter:					
Rate the overall quality of the activity:					
Did the activity avoid commercial bias/influence?	YES		NO		
As a result of this activity, did you learn something new or verify important information you already knew?	Learned something new	Verified prior knowledge		No change	
How long did it take to complete the course?					
What motivational factors helped you to complete an online course? *(i.e. like to learn new things, enjoy online learning, would like to receive a certificate or something else of merit)*					
What is the best time of year to participate in continuing education and why?					
What is the best time of day to participate in continuing education and why?					
Suggestions for future programs:					

Demographics

Age	**Gender**	**Race**	**Zip code:**
A. 17 and younger B. 18-23 C. 24-30 D. 31-40 E. 41 and older	A. Male B. Female	A. White (not of Hispanic origin) B. Black C. Hispanic D. Asian E. Other	

Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Developing Broadband Infrastructure for Rural Areas

Protocol No.: 05-TATDL205-05

Date: March 12, 2008

Protocol Title: Developing Broadband Infrastructure for Rural Areas

Principal Investigator: James F. Gerraughty

Protocol Executive Summary:

This protocol investigated using Internet2 for teaching Medical Spanish and for remote student teacher monitoring. For medical Spanish, the research showed an increase in ratings as well as comments indicating positive student reactions. With regard to the remote student teacher monitoring, the qualitative ratings stayed the same, in the good/excellent range, throughout the testing.

Introduction:

CERMUSA has performed research on distance education using video teleconferencing for several years. This protocol had a foundation in the past research of the HRIR 544, Teaching Sign Language at a Distance, Wireless Campus, Portable and Mobile Classroom, and Weapons of Mass Destruction research protocols (CERMUSA, 2004, CERMUSA 2002-2004, and Grok, 2003). The hypothesis of the research was particular education applications require broadband (10+ MB/s) Internet connections in order to work properly. The purpose of this experiment was to determine what should be transmitted on Internet2 and what does not need to be transmitted over Internet2. The experiment will be broken down as follows:

> Sub hypothesis 1 – Internet2 Student/Teacher Engagement: The Internet2 connection into the various schools will have a positive impact on student teacher monitoring. Student teacher monitoring via Internet2 and Commodity Internet will be as effective as being in the classroom, monitoring the student face-to-face.
>
> Sub hypothesis 2 – Foreign Language Instruction: Foreign Language instruction is often not available due to budgets or the size of the school. Foreign language classes can be taught over Internet2 and are equivalent to face-to-face instruction. Research will compare test scores of students in experimental and control groups, as well as address issues of lip-synching and audio clarity.

This protocol used Video Teleconferencing (VTC) for both the Medical Spanish classes and the remote student teacher monitoring. The VTCs were done over Internet2.

In this protocol, the military significance would be an advancement of communications technology and deployment in rural areas. This has many applications for medicine and just-in-time education on domestic and international military areas with limited or non-existent communication facilities.

The specific benefit to the public purpose in this study is improved data communications. Through this conduit, education, both medical and other, will be delivered to areas that otherwise would not have access. Additionally, a business model will be made comparing costs of setting up this type of communication network to a traditional wired network currently in place in metropolitan and non-rural areas.

Methods:

This protocol was determined to be "exempt from federal regulatory oversight" for fiscal year 2006. Data were collected through surveys administered during each session for both the Medical Spanish and the Remote Student Teacher Monitoring. The surveys can be seen in Appendix A. The survey asked affective questions about audio & video quality, perceived interaction from the far end of the video teleconference (VTC), and the overall impression of the VTC. The reason for the questions regarding the video/audio quality and interaction was the researcher did not want the technology to get in the way of the instruction. If the VTC was disruptive to the students in the medical Spanish class, this data would have an impact on the use of this technology in a classroom setting. The survey also had an open-ended question wherein the respondents were asked to write down impressions, comments, etc. No critical issues were noted; subjects completed their surveys upon request.

Results and Analysis:

Medical Spanish:

As stated earlier, there were two Medical Spanish classes, occurring November 13 and December 4, 2007. Each class had seven (7) participants, with each filling out a survey. The first class's VTC speed was 384 Kilobits per second (Kbps) and the second class was at 768 Kbps. The changes in VTC speeds were part of the research to investigate the effects of VTC speed on language instruction and interaction. Figure 1 shows the layout of the VTC, with the Saint Francis students in the foreground and the University of Puerto Rico instructors on the monitor:

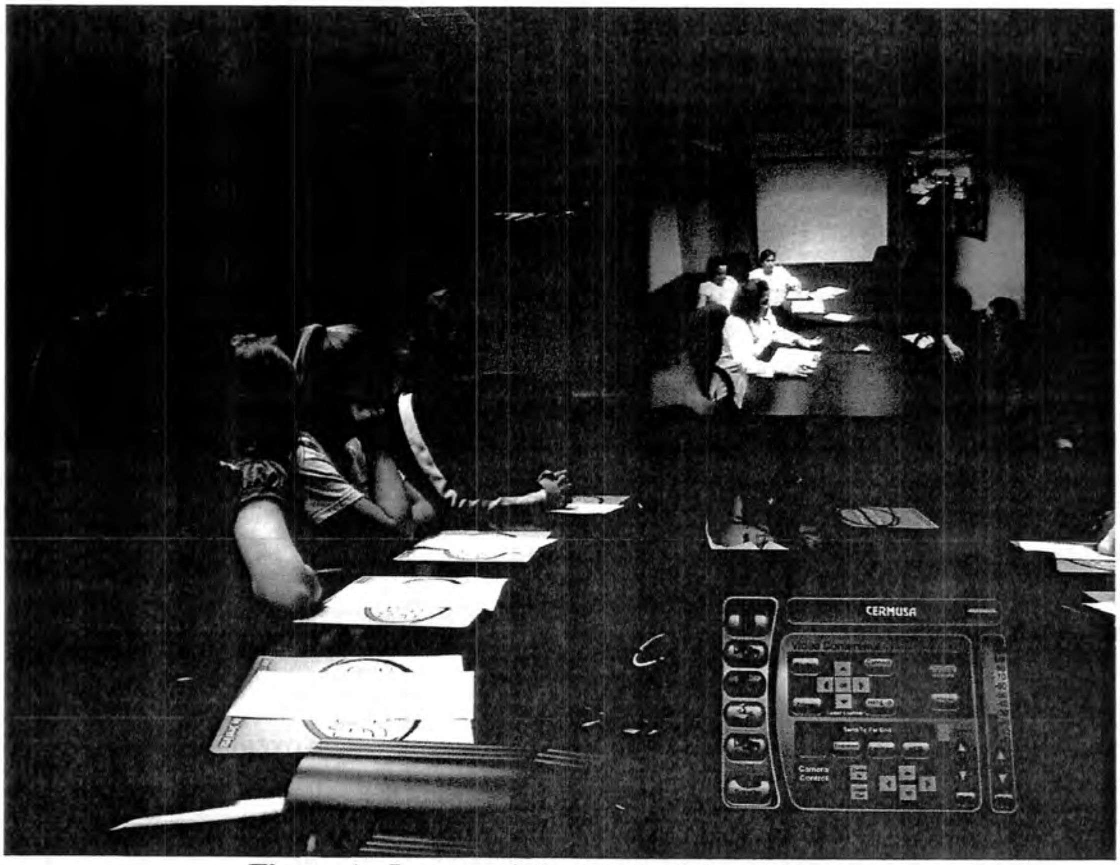

Figure 1: Layout of the Medical Spanish class

Video Quality:

Figure 2 shows the breakdown of the video quality ratings. The VTC speed was 384 Kbps. The ratings ranged from "neutral" to "excellent."

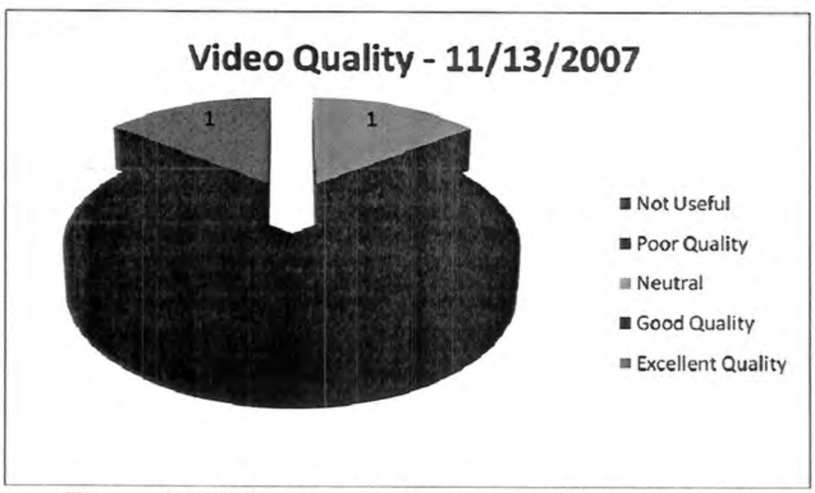

Figure 2: Video Quality Ratings, 11/13/2007 (N=7)

Figure 3 shows the same ratings, but from a different class where the VTC speed was doubled to 768 Kbps:

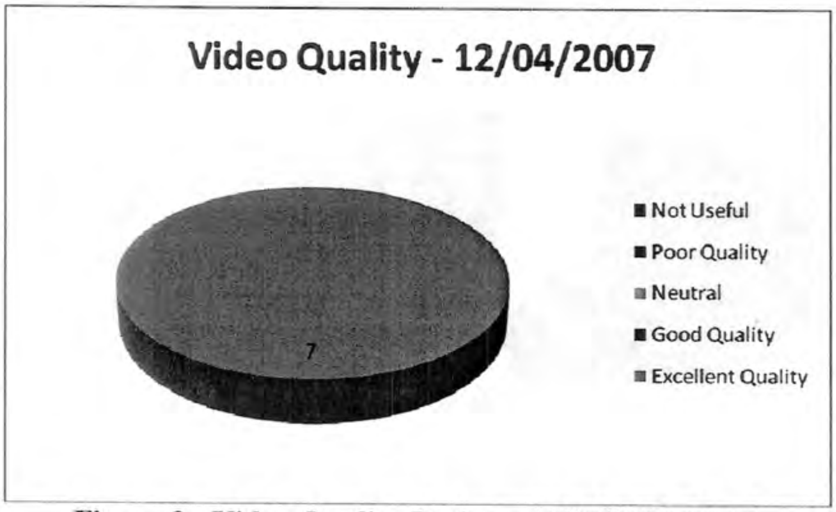

Figure 3: Video Quality Ratings, 12/04/2007 (N=7)

One can see that all the ratings went to "Excellent." This was somewhat expected due to the speed of the VTC and has been noted in previous CERMUSA research studies.

Audio Quality:

Figures 4 & 5 show the ratings for audio quality:

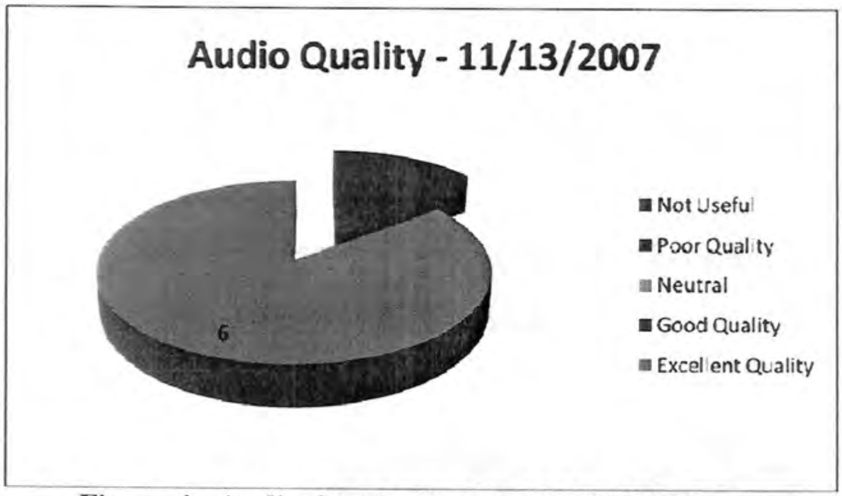

Figure 4: Audio Quality Ratings 11/13/2007 (N=7)

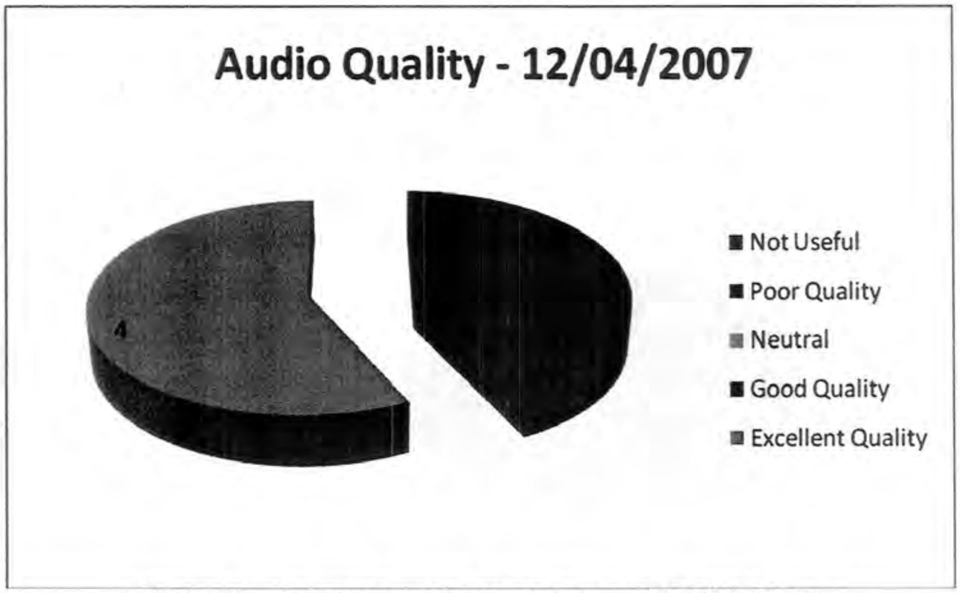

Figure 5: Audio Quality Ratings, 12/04/2007 (N=7)

The audio quality rating went down when the speed of the VTC doubled to 768 Kbps. One possible explanation for this drop was that the second class had more conversation to it as part of the lesson. When multiple participants speak in a VTC, audio can become distorted and this could have led to the lowered ratings from the previous class.

<u>Far-End Interaction:</u>
Far-End Interaction is important to investigate because it shows what the participant felt was the level of interaction they perceived from the far end of the VTC. A lower rating would indicate that the subject felt ignored, while a higher rating would indicate that a subject felt immersed into the VTC. Figures 6 & 7 show the far-end interaction perception:

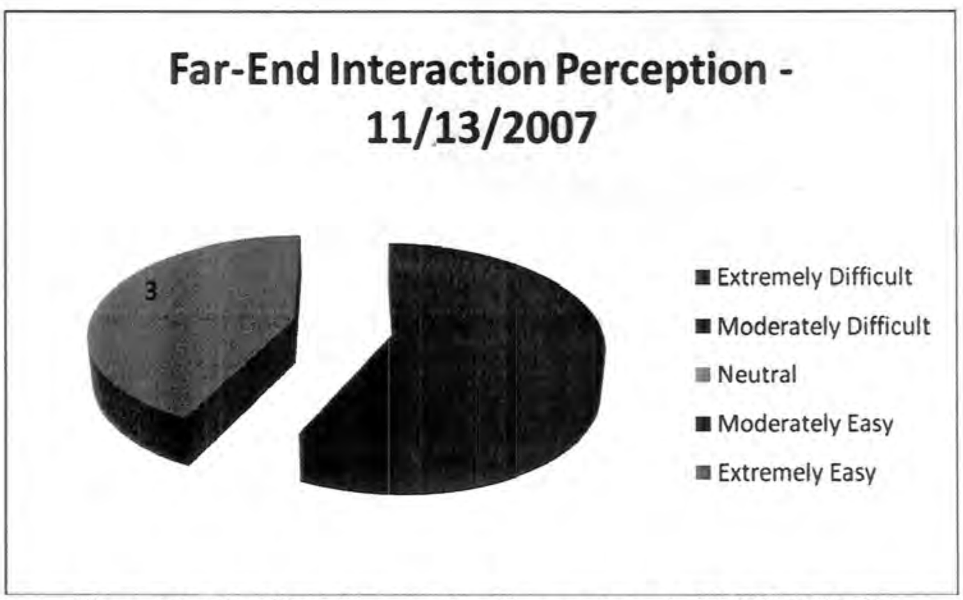

Figure 6: Far-End Interaction Perception, 11/13/2007 (N=7)

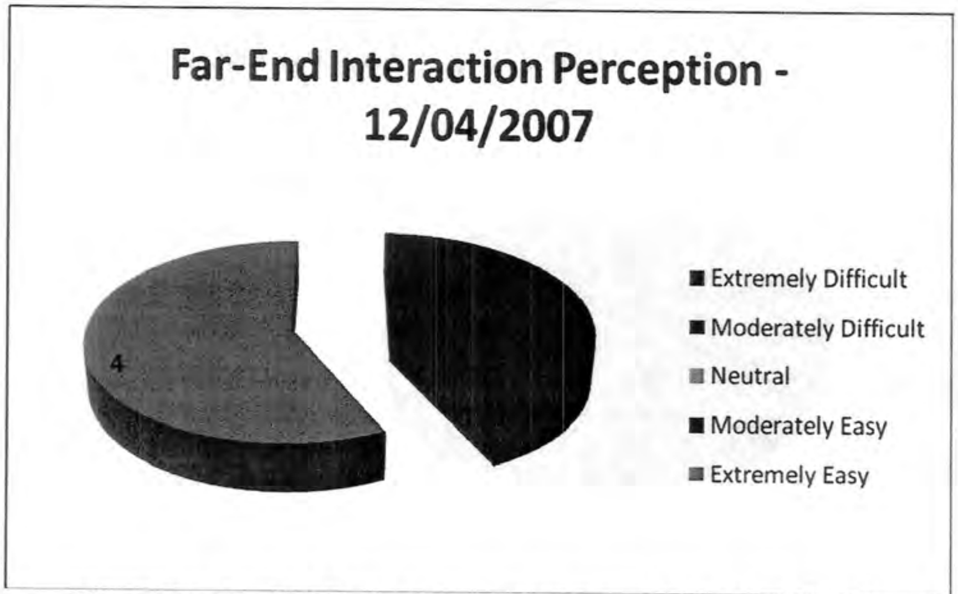

Figure 7: Far-End Interaction Perception, 12/04/2007 (N=7)

The ratings during both classes show that the subjects felt like the far end was physically in the classroom.

Overall VTC Rating:
The overall VTC rating indicates the subjects' satisfaction with the VTC and with the class. Figures 8 & 9 show the difference between the first and second classes:

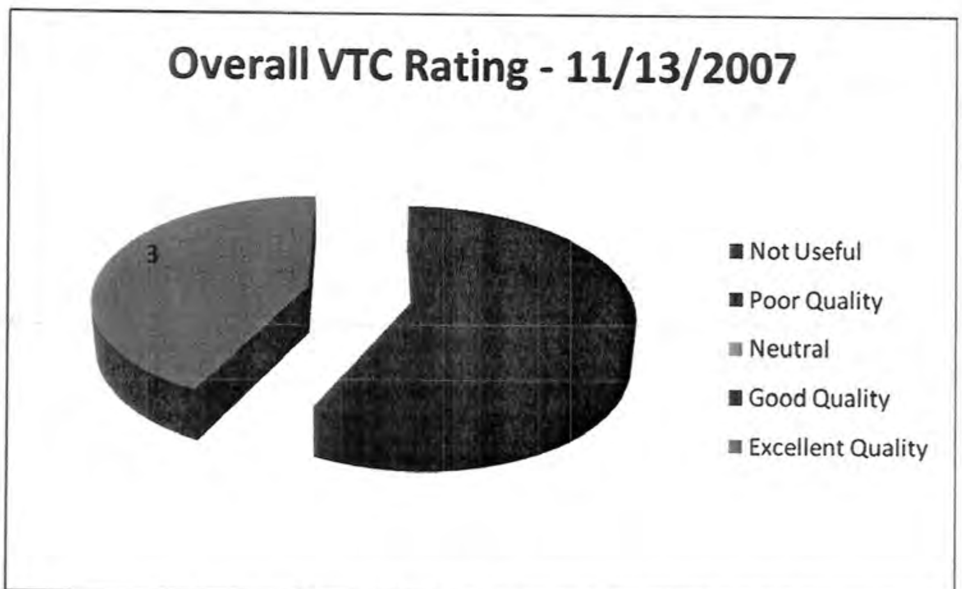

Figure 8: Overall VTC Rating, 11/13/2007 (N=7)

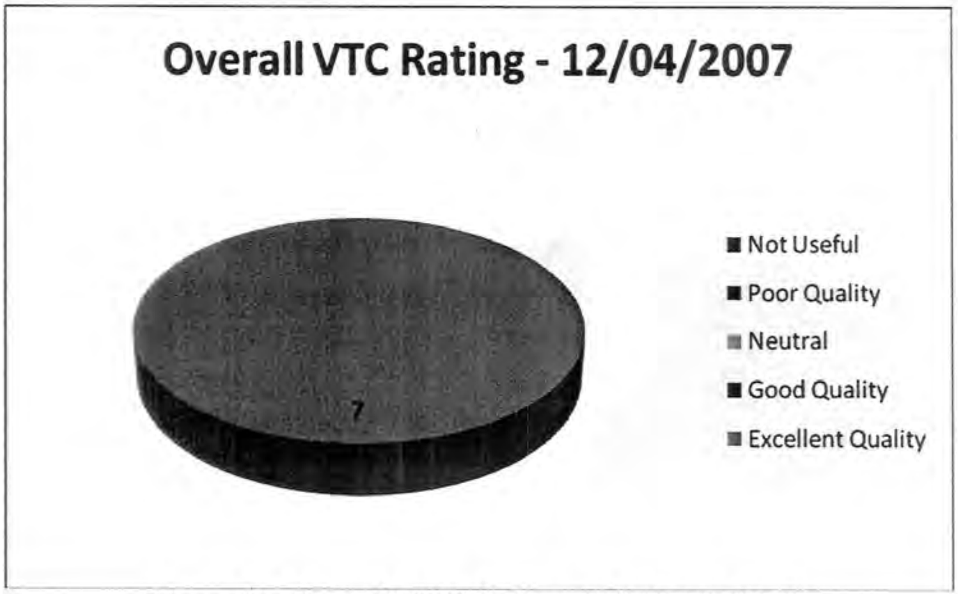

Figure 9: Overall VTC Rating, 12/04/2007 (N=7)

Overall VTC ratings improved through the Medical Spanish class.

The comments pertaining to the class were also telling about using this technology for instruction. "A desire to do it again," "[an] interesting tool for teaching," and "great for clinical immersion" were some of the positive comments from the participants. One comment from the November 13 session, "Difficult to see faces, and I think that's important in a diagnostic exam," could be mitigated in future VTC by better camera placement and more effective camera zooming and panning.

Remote Student Teacher Monitoring:

As stated earlier, there were three remote student teacher monitoring sessions, occurring October 22, November 1, and November 30, 2007. Each session had two (2) participants, each filling out a survey. As in the Medical Spanish classes, the sessions were done via VTC with the 10/22/2007 session's speed at 768 Kbps, the 11/01/2007 session at 1472 Kbps, and the 11/30/2007 session dialed in at 1152 Kbps. Again, just like in the Medical Spanish testing, the speeds of the VTC were adjusted for the research. Figure 10 shows how the sessions were set up and how the monitors viewed the student teacher.

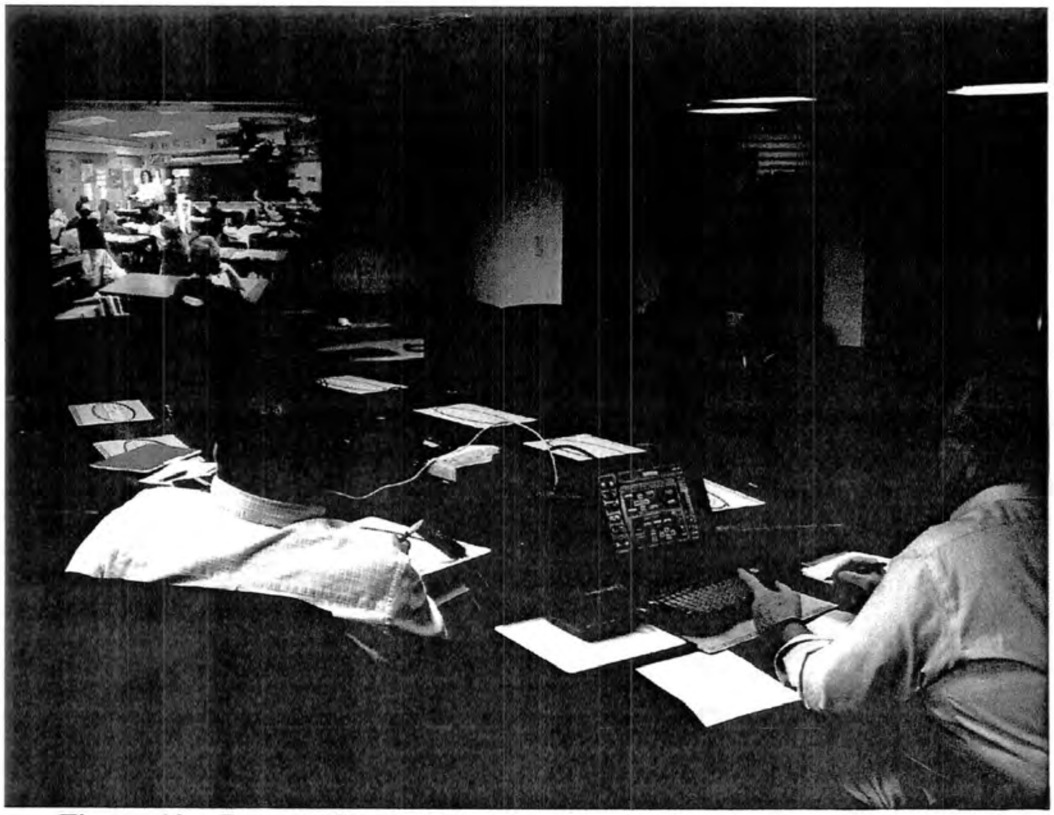

Figure 10 – Remote Student Teacher Monitoring session – 11/01/2007

<u>Video Quality:</u>
Figures 11, 12, and 13 show the changes in video quality over the three courses:

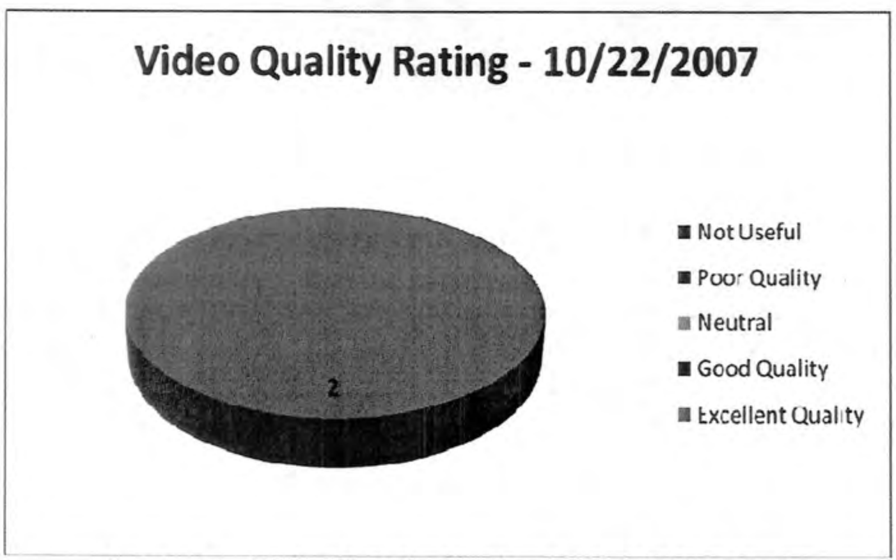

Figure 11: Video Quality Ratings, 10/22/2007 (N=2)

Figure 12: Video Quality Ratings, 11/01/2007 (N=2)

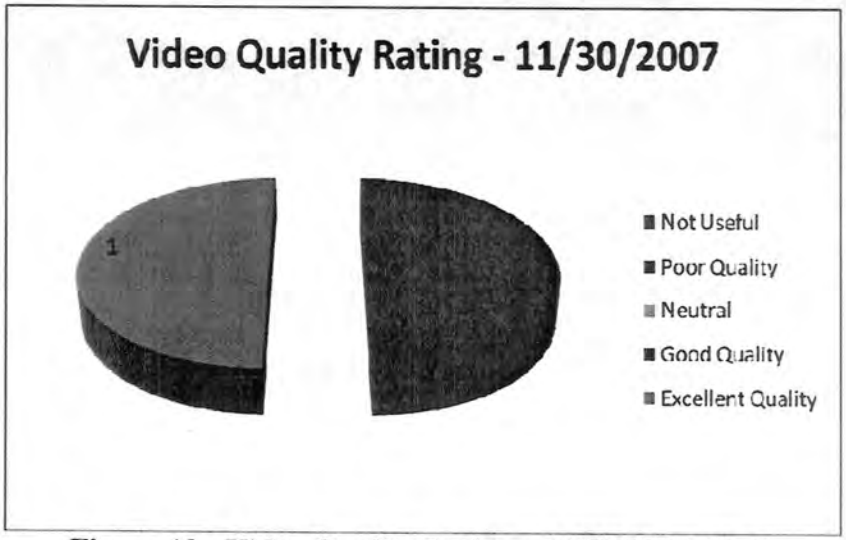

Figure 13: Video Quality Ratings, 11/30/2007 (N=2)

The video quality ratings were either "good" or "excellent" on all of the sessions. This seems to indicate that, for a basic VTC, higher speed will not result in a higher video quality rating. To the participants, the video looked as good at 768 Kbps as it did at 1472 Kbps. Video quality was important for viewing the student teacher in the classroom.

Audio Quality:

As in the Medical Spanish course, the audio was important in the remote student teacher monitoring as the monitors could hear what the student teacher was saying and the responses of the students. Figures 14, 15, and 16 show the audio rating from the three sessions:

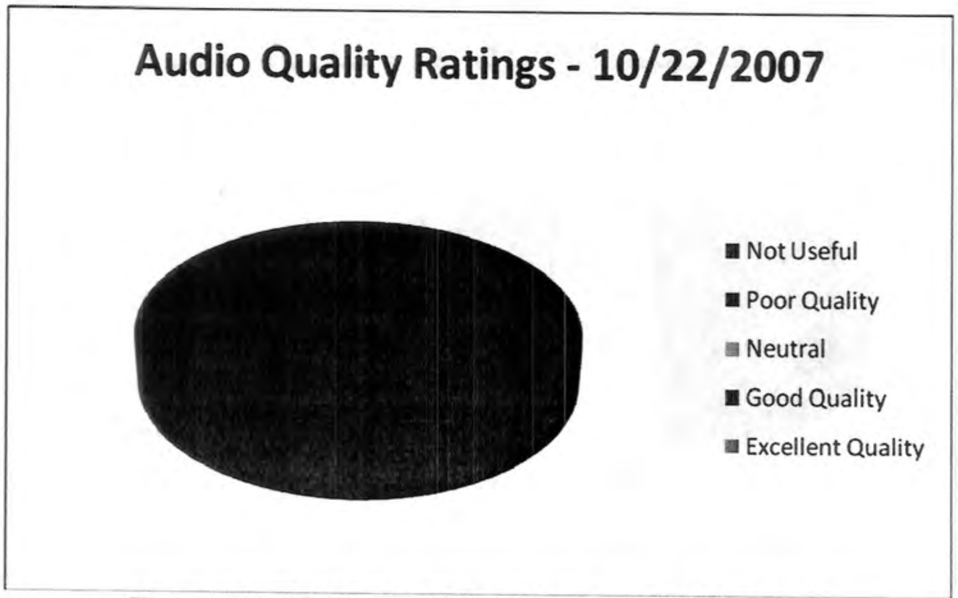

Figure 14: Audio Quality Ratings 10/22/2007 (N=2)

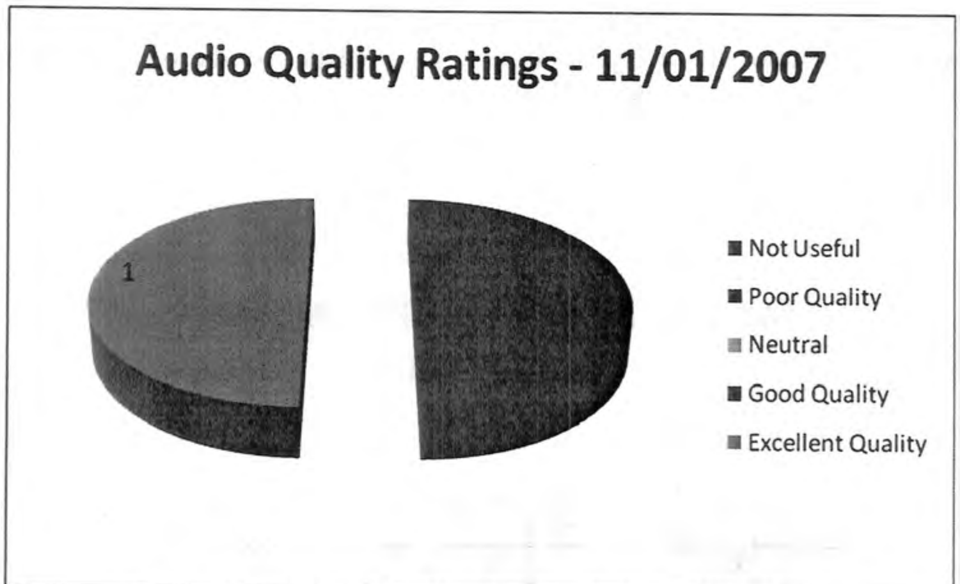

Figure 15: Audio Quality Ratings 11/01/2007 (N=2)

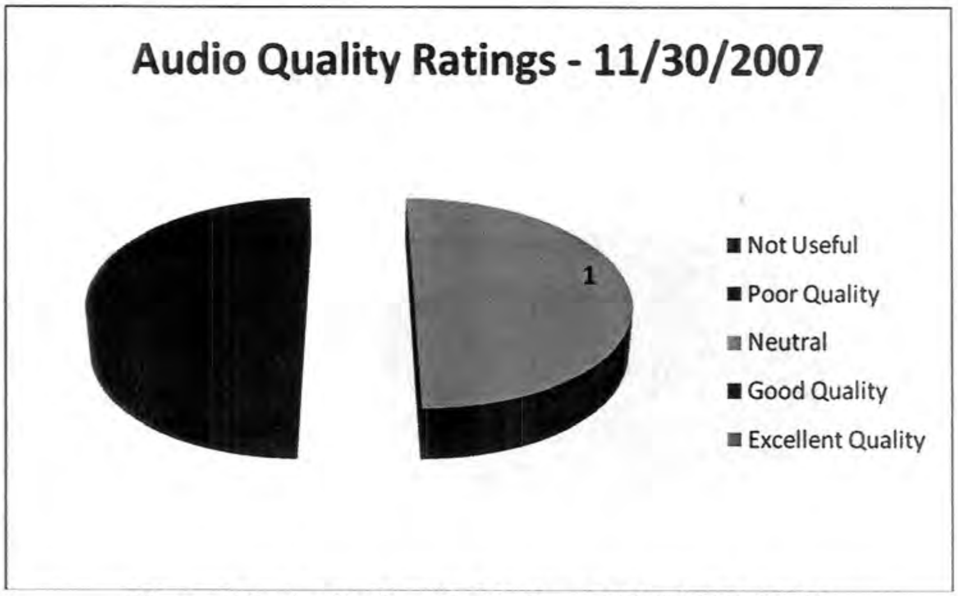

Figure 16: Audio Quality Ratings 11/30/2007 (N=2)

As the sessions went on, the audio ratings moved from "good" to a "good/neutral" rating. This information is interesting; on a technological level, the bit rate (speed) dedicated to audio in a VTC at the speeds tested doesn't change. Monitors had control over the volume in their room. The research does not yield an answer to why the audio ratings went down presently.

Far-End Interaction:
Figures 17, 18, and 19 show the ratings for Far End Interaction Perception:

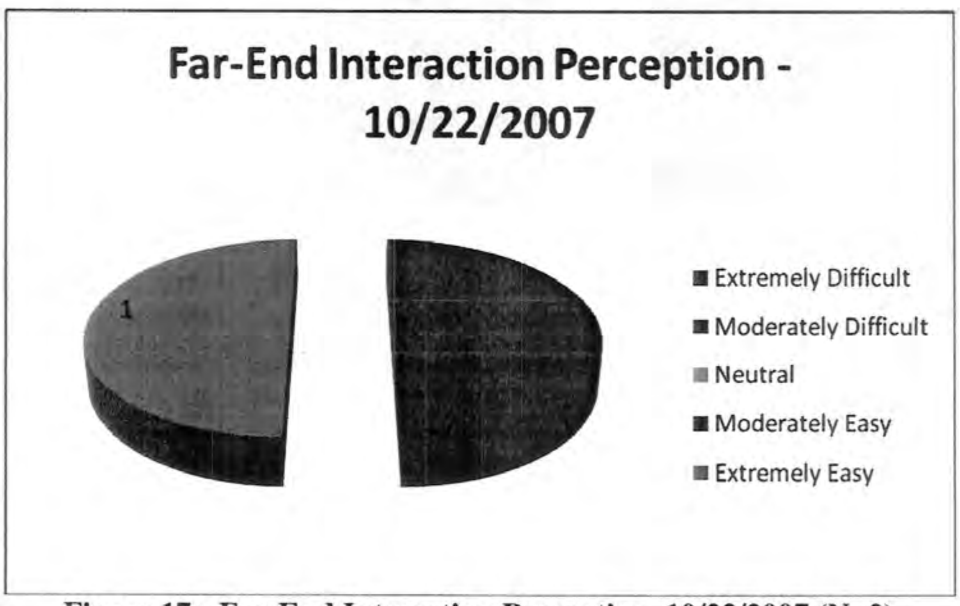

Figure 17: Far-End Interaction Perception, 10/22/2007 (N=2)

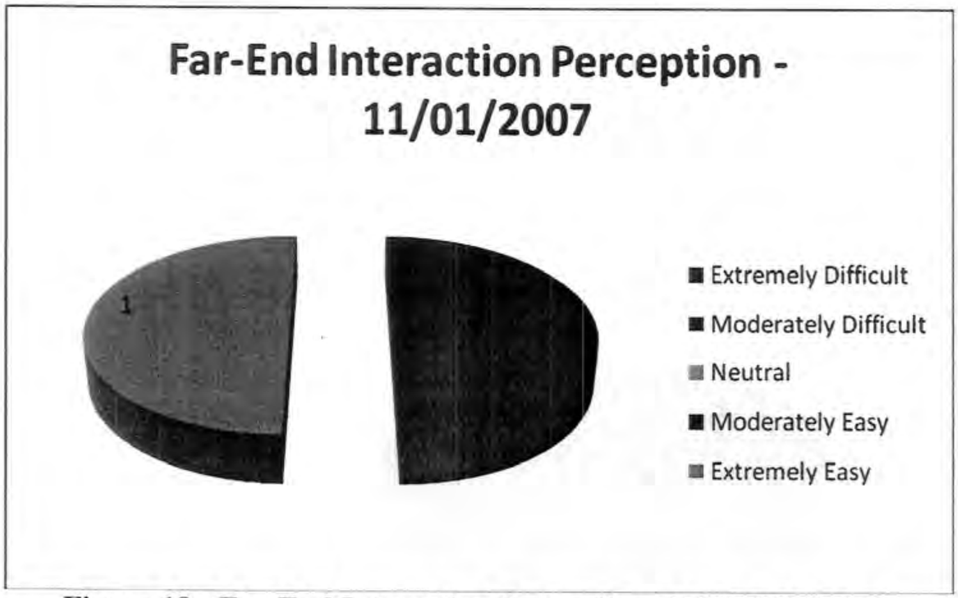

Figure 18: Far-End Interaction Perception, 11/01/2007 (N=2)

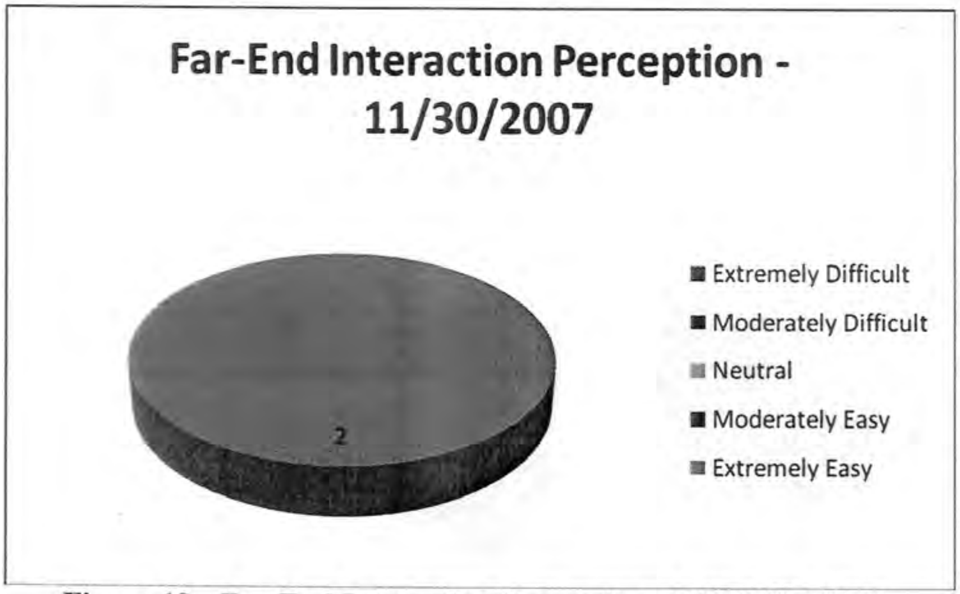

Figure 19: Far-End Interaction Perception, 11/30/2007 (N=2)

The ratings went up as the sessions progressed. The perception of interaction with the remote student teacher monitoring is somewhat different than the Medical Spanish. The monitors were viewing the student teacher in their classroom, but not interacting with them until after the class was dismissed. The interaction following the class's dismissal was used to go over what the monitors saw, what the student teacher felt they did well, on or what they did poorly on. One possible explanation for the upward progression of the ratings is that the monitors gained confidence in using the VTC as a tool for monitoring, and that the monitors were instructed on using the far-end camera control, enabling the monitors to pan/zoom the camera around the classroom. Comments from the monitors become more positive as the sessions go on with regards to using this as a supervision tool and will be presented at the end of this section.

Overall VTC Rating:

Figures 20, 21, and 22 show the ratings for the overall VTC quality:

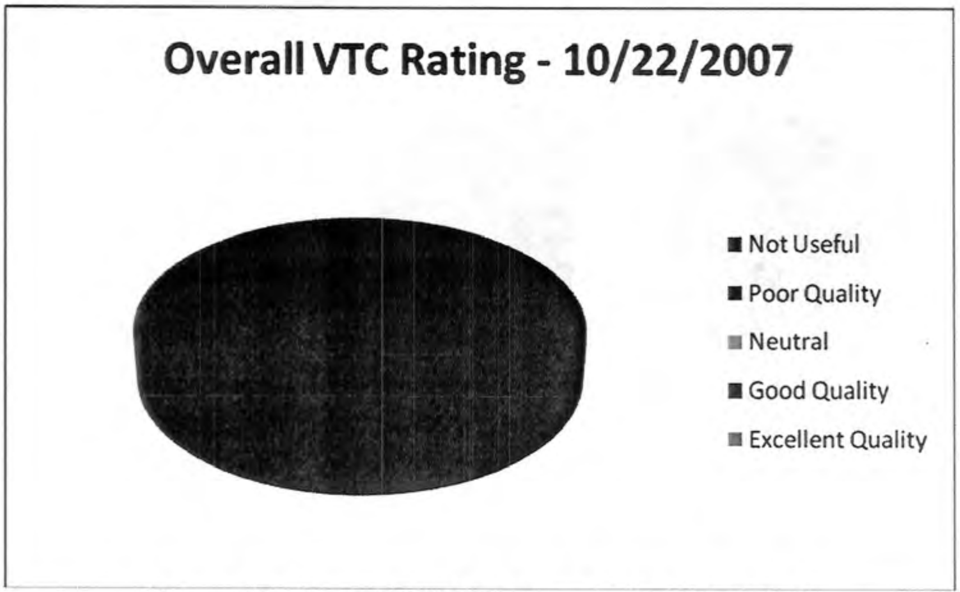

Figure 20: Overall VTC Rating, 10/22/2007 (N=2)

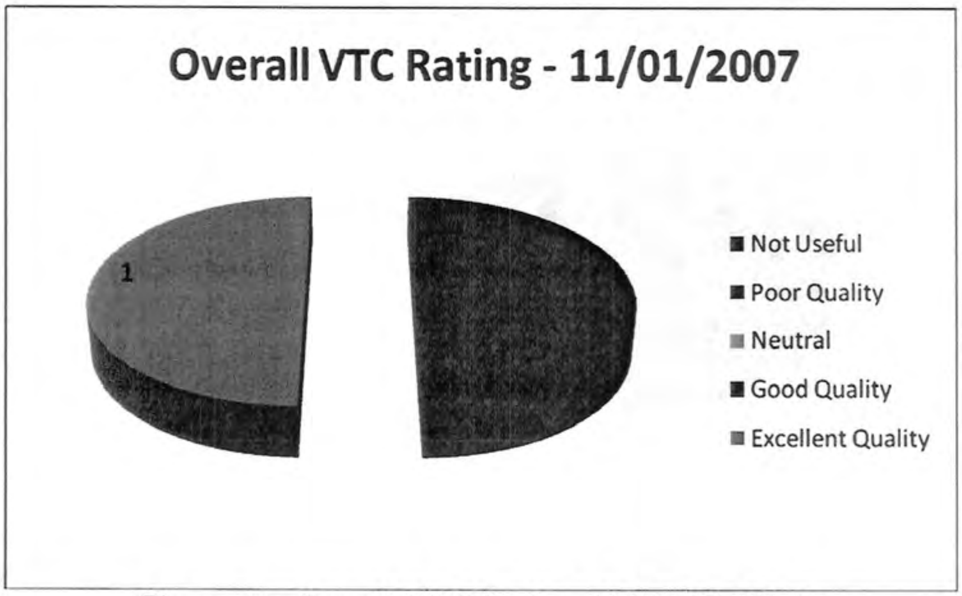

Figure 21: Overall VTC Rating, 11/01/2007 (N=2)

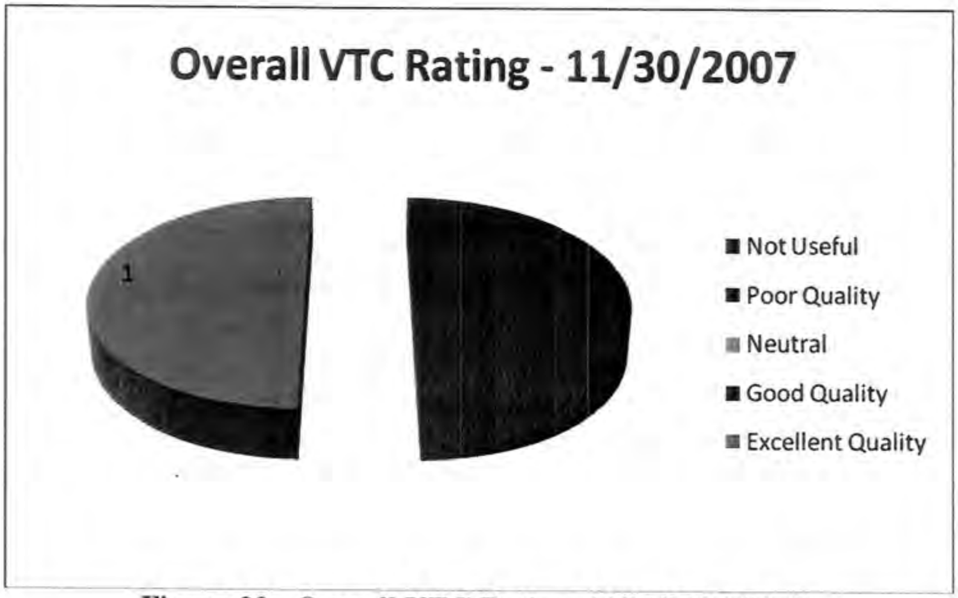

Figure 22: Overall VTC Rating, 11/30/2007 (N=2)

As in the far-end interaction ratings, the ratings for overall VTC went from "good" to "good/excellent" as the sessions progressed.

The comments section of the remote student teacher monitoring surveys was very useful. In addition to the positive comments about the VTC being a good supervision tool, the monitors requested that they be able to "move the camera around the room." This request was granted and the following sessions saw the monitors using this feature often.

This protocol was closed in March of 2008.

Key Research Accomplishments:

Medical Spanish:
The military significance of these findings shows that foreign language training, especially language training for medicine and medical care, can be done at a distance via VTC. This has potential for military medical specialists and military interpreters. This would be ideally coupled with hands-on instructional materials, and could also be used for certification or to see how a student would do in a "real world" medical/translation situation. These findings also have similar utility for civilian education.

Remote Student Teacher Monitoring:
The military significance of the remote student teacher mnitoring would be a way to monitor training and courses for our armed services. The real-time monitoring and instant feedback is important to ensuring the trainers and educators are effective.

Reportable Outcomes:
This research will be submitted for publication in technology and education journals. At the time of this writing none have yet been submitted.

Conclusions:

In conclusion, Medical Spanish worked well and can be used for introductory training in medical environments. The slower VTC class, at 384 Kbps, scored lower on video and overall quality compared to the 768 Kbps class, which points to a need for a minimum speed of 768 Kbps. Tele-diagnosis in a foreign language may be a future research idea. As stated with the military and public significance, this style of training could be used to provide just-in-time training in the field, or as an immersion technique to improve language comprehension.

For remote student teacher monitoring, VTCs can be useful; however, technology considerations (i.e. VTC units in schools, high-end networks, etc.) may cause limitations in its use. It was also determined that the monitors needed far-end camera control not only to monitor the student teacher, but to see what was written on the board and other interactions with the students. If implemented, remote student teacher monitoring would reduce "windshield time" for monitors (17.4 miles/27.6 minutes one-way on average, using 2007 SFU data) and add more interventions without a major added cost. VTC speed above 768 Kbps results in no measurable difference on audio/video quality ratings. Further testing and possible research would be needed for image- or motion-intensive VTCs to see if a higher than 768 Kbps speed is necessary.

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Appendices:

Appendix A – Broadband Infrastructure class/session survey

Appendix A
Survey for Medical Spanish and Remote Student Teacher Monitoring
Developing Broadband Infrastructure for Rural Areas (05-TATDL205-06)

Please fill out this survey. Your responses will aid in the progress of this research protocol.

Please select your answer from the choices below each question.

1) Rate the quality of the video

    High Quality
    Good Quality
    Neutral Quality
    Poor Quality
    Not Useful

2) Rate the quality of the audio

    High Quality
    Good Quality
    Neutral Quality
    Poor Quality
    Not Useful

3) Rate the level of interaction YOU perceived from the far end.

    Extremely Easy
    Moderately Easy
    Neutral
    Moderately Difficult
    Extremely Difficult

4) Please rate today's video teleconference overall

    High Quality
    Good Quality
    Neutral Quality
    Poor Quality
    Not Useful

Comments on the video teleconference:

Thank you for your help in today's demonstration!

Saint Francis University's
Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA)

FY06 Annual Report
(March 12, 2007 to March 11, 2008)

Protocol Title: Wireless Test Bed

Protocol No.: 05-TATTH206-05

Date: March 12, 2008

Protocol Title: Wireless Test Bed

Principal Investigator: Kent Tonkin

Protocol Executive Summary:

CERMUSA's Wireless Test Bed is an ongoing research study that serves as an open development lab for wireless technologies. As in the past, the Wireless Test Bed has performed both independent technology research and development of systems and methodologies to support other CERMUSA projects, such as the First Responder Emergency Communications-Mobile (FREC-M) and the Mobile Communications Platform (MCP).

For the 2006-2007 project year, CERMUSA focused on three specific wireless projects within the Wireless Test Bed:

- RF to IP Bridge System
- Mesh Network
- Mobile Access Point

This year's Wireless Test Bed project work focused mainly on modular and rapidly-deployable communications networks for emergency and tactical response. This approach mirrored interests within the DOD community, as a number of Broad Agency Announcements, including DARPA's LANDroids initiative, came to light during this research period. The majority of these projects represent revision and continued development of ad-hoc networking types of technologies.

I. RF to IP Bridge System:

Introduction:

The RF to IP Bridge System was developed to extend licensed radio frequency voice communications into areas unreachable by radio repeaters. By using non-licensed frequency wireless local area network (WLAN) access points (in 900 MHz and 2.4/5.8GHz ISM bands) as point-to-point wireless network nodes, CERMUSA staff was able to convert radio voice traffic into TCP/IP data and back.

This process was achieved by using a unique combination of commercially-available off-the-shelf (COTS) products and was developed in response to needs stated by the Johnstown Fire Department. The Johnstown Fire Department approached CERMUSA to determine if they could gain assistance in extending radio coverage within several buildings. According to Fire Department staff, voice radio service was largely unavailable in many buildings because the handheld radios were simply not capable of making contact with the radio repeater tower. CERMUSA analyzed existing technologies on the market and found that a complete off-the-shelf solution did not exist. As such, CERMUSA staff identified a series of components that could be combined to provide a radio "bridge" between the interior and exterior of the building. This bridge was accomplished by attaching hand-held voice radios to battery powered WLAN access points via a Raytheon device known as the NXU-2A Network Extension Unit. The modular device chassis was also developed at CERMUSA during previous research to operate in a mesh architecture (2.4/5.8GHz) or in a point-to-point mode (900MHz) for the purposes of data connectivity. The chassis was rugged, water-resistant, and capable of continuous operation for 8-10 hours without an external power source. Additionally, these devices could be powered by AC and 12-volt batteries and include a solar trickle-charger on the top of each box.

The Raytheon NXU-2A Network Extension Unit is marketed to call centers to allow operators at 911 or other operational buildings to receive incoming calls from a number of remote two-way radio systems via IP, but was never intended for use as an IP bridging device in point-to-point two-way radio conversations. To our knowledge, no other group in the country is using the Raytheon NXU-2A Network Extension Unit for our application.

Methods:

CERMUSA used funding from the Keystone Innovation Zone program to apply for both design and mechanical patents for the RF to IP Bridge System in May 2007. Immediately following this application, the RF to IP Bridge System was publically presented at the annual Johnstown Showcase for Commerce.

Although CERMUSA and the Johnstown Fire Department quickly came to consensus on an experimental use agreement, obtaining signatories from Johnstown City Government took several weeks. By September 2007, CERMUSA Administration also determined that a full Institutional Review Board (IRB) application would be required for both TATRC and Saint Francis University. Within 30 days, this application was completed and approved. Research on this project officially kicked off in October 2007.

CERMUSA issued a pair of RF to IP Bridge System units to the Johnstown Fire Department in October 2007 for experimental use. Following each use, members of the fire department were instructed to complete a paper evaluation form to provide data on system performance and difficulties.

During October through December 2007, CERMUSA staff provided hands-on training to the Johnstown Fire Department. The RF to IP Bridge System has been in active deployment with the Johnstown Fire Department. Due to the administrative delays encountered, the data gathering period and associated experimental use agreement has been extended until July 2008.

Results and Analysis:

Field testing of the RF to IP Bridge System officially began in December 2007 and is ongoing. At this point, the Johnstown Fire Department has used the system during three live events and have experienced the following problems:
Operator Error – Firemen accidentally turned the connected two-way radios to the wrong channels. Having the Outdoor Unit and Indoor Unit on incorrect channels would render the system useless for extending communications. In the event of this failure, firemen would still have use of whatever existing range their voice radios could provide, equivalent to "normal" operations without the RF to IP Bridge System.

Accidental Power-Down – Firemen accidentally bumped the toggle switches controlling battery power to the unit and switched it off during operation. After a reboot, a link could not be established again for an unknown reason. Further investigation of this failure is ongoing.
Physical Damage – The two-way radio audio interface connector was accidentally kicked during operation. This caused the plastic connector to break off of the box rendering the unit unusable until repairs could be made.

These accidents have given valuable information allowing CERMUSA technical staff to perform a substantial revisions to the chassis of the RF to IP Bridge System, based both on user feedback and in-house technical ideas. New chassis attributes include a strobe location beacon (for locating an RF to IP Bridge System unit in a dark or smoky environment), use of a safety-orange colored case (for easier location/identification with emergency services) and simplification of user interface (reduction of the number of power buttons on the case and fewer LED indicators). As of January 2008, CERMUSA staff has performed a first round of repairs, including the chassis revisions. Additional required repairs and revisions are expected throughout the next six months. At this point, end-user feedback surveys will be tallied and tabulated to determine which features did or did not work well.

II. Mesh Network:

Introduction:

CERMUSA developed a modular Mesh Network capable of rapid deployment and extended operation. Based in the same rugged enclosures utilized for the RF to IP Bridge System, each node in this network was built to be capable of functioning from multiple power sources (AC, DC, solar trickle charge) to operate for at least 8 hours with no external power supply. Using exclusively COTS equipment, the CERMUSA Mesh Network consists of a gateway box (for connectivity to wired networks, satellite backhauls, etc) and a series of ten nodes capable of providing connectivity over four "hops" in any direction. Additionally, the Mesh gateway box features a Linux-based cellular gateway device which will provide automatic backup connectivity in the absence of other backhaul communications.

Methods:

Development and revision on this system has been continuous since 2005. During the 2006-2007 project year, CERMUSA technical staff began revision of the existing mesh system to leverage improvements in both mesh firmware and backhaul technologies. The original intention was to use a newer, OEM-board style mesh access point capable of either dual 802.11a or 900MHz backhauls. The use of dual backhauls would increase the total number of network "hops" in a given direction from 4 to 10+, and would also increase total throughput. Technical difficulties concerning component availability and firmware compatibility have delayed the revised integrated system from completion thus far in the 2006-2007 project year. These details will be further discussed in the Results and Analysis part of this report.

Results and Analysis:

CERMUSA technical staff made few changes to the Mesh Network during the 2006-2007 project year, mainly due to difficulties in acquiring parts and dealing with compatibility issues.

During the 2006-2007 project year, a revised design on the Mesh Network was developed. Rather than performing upgrades to the existing system it was decided to construct an entirely new 2nd Generation Mesh Network utilizing 12 Nodes and 1 Portal box.

This system will have several major improvements over the current Mesh Network architecture:

1. Upgraded power delivery system – Three toggle switches on the box will be replaced by a single industrial strength plunger-type push-button switch.
2. Commercial-grade Mesh Engine backhaul – These units employ a dual-radio backhaul separate from the client connections. Using a dual-radio backhaul allows more hops in any one direction without the accompanying bandwidth degradation. These units will also be capable of either a 5.8GHz backhaul or 900MHz for better signal propagation through foliage and uneven terrain. The modular Mesh Engine boards also have standard slots enabling the backhaul and client radio types to be rapidly reconfigurable for different applications.

CERMUSA has encountered some problems with the Mesh Dynamics Mesh Engine boards so far. There were difficulties with the units not meshing properly during initial testing. A firmware upgrade solved this difficulty and convergence to 900MHz backhaul on several of the units has not been a problem. At present, we are having trouble getting client devices to connect to the 802.11b/g radios installed in the Engine Boards because they are not behaving like a normal Access Point with their transmit signals. We are currently pursing active troubleshooting of this matter with the manufacturer.

Despite the lack of a revised system, the idea of a Mesh Network has proven useful in a number of associated projects and demonstrations, including support of Operation Red Rose (a National Guard training drill) and Monmouth University project work. Through this exercise and ongoing project work, CERMUSA has demonstrated the robust usefulness of the Mesh Network by providing network and internet connectivity, including fall-back redundancy, for several live exercises. Other than the lack of a system revision, no major obstacles were encountered and the system met or exceeded all expectations. The original Mesh Network design continues to work flawlessly for any uses CERMUSA devises to this date.

III. Mobile Access Point (MAP):

Introduction:

The Mobile Access Point (MAP) was developed as a fully-functional node on the CERMUSA Mesh Network mounted on a wheeled robotic chassis. As a result, the MAP can extend network services via remote control, thereby keeping a remote operator out of potentially dangerous areas such as disaster zones or contaminated regions. In addition to network access devices, the MAP was also equipped with a video camera (for remote teleoperation and scene assessment) an onboard micro PC with videoconferencing software, and a microphone and speakers (to allow for communication with potentially injured or contaminated individuals). By using a "daisy-chain" scenario, multiple MAP units could be extended over ridges or other obstacles to extend network coverage within mesh performance limits.

Methods:

CERMUSA began development of the Mobile Access Point (MAP) project in winter 2006, with construction and prototyping following in spring 2007. The original intent for the MAP was to create a robotic extension of CERMUSA's modular mesh network. Using a COTS robotic platform, the MAP was constructed on a four-wheel drive chassis, and was configured for remote operation and simultaneous transmission of motion video and two-way audio. All of these functions could also be performed while simultaneously extending the Mesh Network "footprint" access and connectivity. In these capacities, the MAP was intended to establish network connectivity and data transmission in hazardous areas prior to the deployment of human first responders, and to provide situational "reachback" to command centers. The MAP integrated all major attributes of CERMUSA's Mesh Network, encompassing all of the connectivity and flexible power attributes of these devices.

With the assistance of several interns majoring in engineering, CERMUSA technical staff selected the robotic chassis, computing components, and command-and-control attributes that would be necessary to create a remote-controlled robotic access point. The intention was to integrate as much of the existing CERMUSA Mesh Networking node components into a robotic platform. A market survey began in February 2007, with all parts arriving at CERMUSA by April 2007. The first prototype MAP unit was completed and functional by July 2007.
With a robust platform and remote control capability, MAP units can be used to extend network coverage in a "daisy chain" configuration. When an individual MAP reaches the end of its coverage with the mesh network backhaul, another MAP can be deployed to extend the reach of that unit, thereby extending access over difficult geography (hills, ridge tops) or radio propagation limitations.

Results and Analysis:

Mobile Access Point (MAP):

CERMUSA's major success in the MAP project is the construction of a functional prototype. This prototype system successfully transmitted two-way voice and video while being remotely controlled. A remote driver was able to visually navigate terrain and conduct two-way communications with individuals in outdoor and indoor testing areas. The MAP also successfully acted as a Mesh Network repeater with nearly identical performance to the traditional Mesh Network units (i.e. identical transmission range).

Despite a successful first-unit build as of summer 2007, CERMUSA is continuing to modify and construct a second generation MAP to begin "daisy-chain" range testing. Several mechanical failures have added significant delay to this project, as has sporadic parts availability for the existing low-cost chassis. A second MAP is anticipated to be constructed and functional by the end of January 2008, with measured range testing/network hand-offs to begin immediately thereafter.

CERMUSA staff anticipates the use of a different chassis once the initial development phases are complete. Despite the low cost and relatively high-functionality of the existing MAP chassis, several limiting issues are apparent:

1. Suspension: The current platform was designed with the intent to be used on relatively flat terrain. With this in mind, the lack of a suspension causes ground clearance and the nature of terrain to be concerns. Although not the ideal platform for this development, it has proven to be viable in situations less than ideal, including grassy fields, parking lots, small hill climbs, and building deployments. This platform is, however, limited in areas such as climbing over rocks, parking lot curbs, steep hills, and steps.
2. Weight capacity: This platform has the ability to tow 50 pounds. However our existing equipment has taken up a large portion of that capacity and adding additional payloads can push the vehicle to its limits rather quickly.
3. Size: This platform is rather small and required extensive modifications so additional equipment could be installed. However, in the future as equipment is made smaller, this problem might not be an issue.

Key Research Accomplishments for Wireless Test Bed (All Projects):

- Construction of a functional, low-cost RF to IP Bridge System
- Implementation of RF to IP Bridge System in live test environment
- Use of Mesh Networking devices by multiple groups during live test scenarios
- Construction of a functional prototype mobile access point
- Construction of Mesh Network revision plan

Reportable Outcomes (All Projects):

- Application for two U.S. Patents (design and mechanical, RF to IP Bridge System)
- Demonstration of successful project work to Congressman Murtha
- Television and print coverage (RF to IP Bridge System)
- Support of multiple high-profile events (including Operation Red Rose and CIMERC New Kensington Project)
- Potential project work with IUP Research Institute, NIOSH, and Monmouth University
- Potential for tech transfer/commercialization

Conclusions (All Projects):

CERMUSA's Wireless Test Bed continues to integrate and modify useful combinations of commercial-off-the-shelf technologies to fill niche communications requirements. The final data gathered from the RF to IP Bridge System deployment with the Johnstown Fire Department will enable CERMUSA technical staff to further refine and develop all associated components.

Despite the difficulties encountered in developing both the Mobile Access Point and second version of the Mesh Network, we anticipate major progress within the 2007-2008 funding cycle. Next steps are likely to include: multiple node MAP testing, revised Mesh Network nodes, and longer-range between nodes.

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